8400B Plus Data Module

User's Guide

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Issue 2
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Acknowledgment This document was prepared by the Product Documentation Development group, Avaya Inc., Middletown, NJ.

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About This Document

Purpose

The purpose of this guide is to provide information for installing, operating, testing, and troubleshooting the 8400B Plus Data Module.

Organization of This Guide

The following paragraphs summarize the chapters and appendices contained in this guide.

- Chapter 1, “Introduction,” discusses the basic operating features of the 8400B Plus Data Module and describes the external indicators and connectors.
- Chapter 2, “Installation,” describes the hardware and software required for installing the 8400B Plus Data Module, and outlines procedures for preparing the 8400B Plus Data Module for operation.
- Chapter 3, “Configuration and Operation,” describes how to issue commands to your 8400B Plus Data Module. In addition, it describes how to change, store, and recall configuration parameters, and outlines how to create and save custom configuration profiles. It also provides some basics on the operation of the 8400B Plus Data Module, outlines a typical on-line data session, and discusses more advanced command usage with example command lines. If you are not familiar with the AT

command interface and you are not using your 8400B Plus Data Module with a PC communications package, you will need to familiarize yourself with this chapter.

- Chapter 4, “Troubleshooting,” describes procedures for troubleshooting problems that may be encountered while configuring and operating the 8400B Plus Data Module.
- Appendix A, “AT Command Set,” contains an explanation of each AT command accepted by the 8400B Plus Data Module.
- Appendix B, “Dial Modifiers,” contains an explanation of each Dial Modifier accepted by the 8400B Plus Data Module.
- Appendix C, “S-Registers,” contains an explanation of each S-register used by the 8400B Plus Data Module.
- Appendix D, “Isolating Problems Using Loopback Data Tests,” provides information on how to perform loopback tests and how to isolate problems using the 8400B Plus Data Module.
- Appendix E, “Quick-Reference Summaries,” contains quick-reference summaries of AT commands, S-registers, result codes, factory-default configuration settings, EIA/TIA-574 pin-outs, and the ASCII character set.

A glossary and an index are provided at the rear of this guide.

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For more information about Lucent Technologies documents, see *Business Communications Systems Publications Catalog*, 555-000-010.

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Conventions Used

Throughout this guide, command lines that are typed are shown in typewriter-style characters, and responses that the 8400B Plus Data Module returns are shown in italics. The following is an example.

```
AT H ENTER

OK
```

Note the following characteristics of the display representation:

- The first line is a command line as it should be typed. The ENTER symbol, when shown, indicates that you must press the Enter or Return key to complete the command line.
- Spaces are used to separate commands in some examples shown in this guide. In actual use, the spaces may be typed, but they are not required.
- The second line in the example shows a typical response returned by the 8400B Plus Data Module.

Throughout this document, toll fraud security hazards are indicated by an exclamation point inside a triangle and the words *Security Alert*.

Security Alert:
Security Alert indicates the presence of a toll fraud security hazard. Toll fraud is the unauthorized use of your telecommunications system by an unauthorized party (for example, persons other than your company's employees, agents, subcontractors, or persons working on your company's behalf). Be sure to read "Your Responsibility for Your System's Security" on the inside front cover of this book and ''Security Issues'' on page xi of this section.

Security Issues

As a Lucent Technologies customer, you should be aware that there is an increasing problem of telephone fraud. Telephone toll fraud can occur in many forms, despite the numerous efforts of telephone companies and telephone equipment manufacturers to control it. Some individuals use electronic devices to prevent or falsify records of these calls. Others charge calls to someone else's number by illegally using lost or stolen calling cards, billing innocent parties, clipping onto someone else's line, or breaking into someone else's telephone equipment physically or electronically.

Today security problems are not just limited to toll fraud. There have been sharp increases in reported incidents of hackers: criminals skilled in reprogramming computer systems, accessing telecommunications systems through remote administration or maintenance ports. These ports cannot be used to place phone calls, but hackers can gain control over the setup of the system. Through these ports, hackers create security "holes" to allow unauthorized calling — a serious form of electronic vandalism.

Maintenance ports are their most recent target of abuse. In this scenario, hackers find a private branch exchange (PBX) maintenance port number with their "war dialer"; a device that randomly dials telephone numbers until a modem or dial tone is obtained. They then "hack" the user ID and password, sometimes just by using the PBX default passwords, to enter your system.

This is the most dangerous type of abuse because, once in your system, the hackers have control over all the administrative commands. While in your system, they have been known to:

- Turn on Remote Access or Direct Inward System Access (DISA). Hackers have been known to change the system at 8:00 p.m. to allow fraudulent calls. Then, at 3:00 a.m., they reprogram the system back to its original configuration. One company was hit three weekends in a row before it realized what was happening.
- Turn off Call Detail Recording (CDR) or Station Message Detail Recording (SMDR), hack your system all weekend, then turn it back on before Monday morning. This is especially disturbing to managers who

are security conscious and check the CDR/SMDR reports every morning looking for suspicious activity. They will not see records of the calls because CDR/SMDR was turned off by the hackers. The administrator may notice the absence of CDR/SMDR records for evening, night, and weekend calls made by employees.

NETCON Data Channels

The NETCON (Network Control) data channels provide internal access to the system management capabilities of your DEFINITY® Communications System. If the 8400B Plus Data Module is connected to a modem, or there is a modem pool, your system may be at risk for toll fraud.

Expert toll hackers will target the administration and maintenance capabilities of your system. Once criminals gain access to the administration port, they are able to change system features and parameters so that fraudulent calls can be made. In a modem pool or NETCON modem installation, this would also permit a hacker to transfer to a NETCON extension, get data tone, and obtain a login prompt — permitting transfer out to make toll calls.

If the data module or modem must be connected to a NETCON administration port, then deny access to any high-risk features or endpoints by placing them in restriction groups on the DEFINITY Communications System. This restricts their accessibility from the incoming facility or endpoints that could transfer a call.

Also, use Class of Restriction to Class of Restriction (COR-to-COR) to restrict stations from calling the NETCON data channels, so that only CORs allowed to access the maintenance port are able to do so. For example, if voice mail extensions have a COR of 9, and extensions assigned to NETCON channels have a COR of 2, ensure that COR 9 does not have access to COR 2. Anyone not authorized to use the NETCON channel should not be able to access it.

In addition, a data module or modem port used for voice mail maintenance or administrative access is often a switch extension. It should be restricted in the same manner as the NETCON channel.

PBX Security Measures

Everyone in your company who uses the telephone system is responsible for system security. Users and attendants need to be aware of how to recognize and react to potential hacker activity. Informed people are more likely to cooperate with security measures that often make the system less flexible and more difficult to use.

Implement the following general security measures to protect your PBX, and discourage the unauthorized use of your communications system.

- Never program passwords or authorization codes onto auto-dial buttons. Display phones reveal the programmed numbers, and internal abusers can use the auto-dial buttons to originate unauthorized calls.
- Discourage the practice of writing down passwords. If a password needs to be written down, keep it in a secure place and never discard it while it is active.
- Attendants should tell their system manager if they answer a series of calls where there is silence on the other end or the caller hangs up.
- Users who are assigned voice mailboxes should frequently change personal passwords and should not choose obvious passwords.
- Advise users with special telephone privileges (such as Remote Access, voice mail outcalling, and call forwarding off-switch) of the potential risks and responsibilities.
- Be suspicious of any caller who claims to be with the telephone company and wants to check an outside line. Ask for a callback number, hang up, and confirm the caller's identity.
- Never distribute the office telephone directory to anyone outside the company; be careful when discarding it.
- Never accept collect phone calls.
- Never discuss your telephone system's numbering plan with anyone outside the company.

- Change passwords frequently (at least quarterly). Set password expiration times and tell users when the changes go into effect. Changing passwords routinely on a specific date (such as the first of the month) helps users to remember to do so.
- Establish well-controlled procedures for resetting passwords.
- Limit the number of invalid attempts to access a voice mail to five or less.
- Monitor access to the dial-up maintenance port. Change the access password regularly and issue it only to authorized personnel. Consider using the Remote Port Security Device (RPSD) — a Lucent Technologies product that helps protect your administration and maintenance ports from unauthorized access.
- Create a PBX system management policy concerning employee turnover and include these actions:
  - — Delete all unused voice mailboxes in the voice mail system.
  - — If an employee is terminated, immediately delete any voice mailboxes belonging to that employee.
  - — If a terminated employee had Remote Access calling privileges and a personal authorization code, remove the authorization code immediately.
  - — If barrier codes and/or authorization codes were shared by the terminated employee, these should be changed immediately. Notify the remaining users as well.
  - — If the terminated employee had access to the system administration interface, their login ID should be removed (G3V3 or later). Any associated passwords should be changed immediately.
- Back up system files regularly to ensure a timely recovery should it be required. Schedule regular, off-site backups.
- Keep the attendant console and supporting documentation in an office that is secured with a changeable combination lock. Provide the combination only to those individuals having a real need to enter the office.

- Keep telephone wiring closets and equipment rooms locked.
- Keep telephone logs and printed reports in locations that only authorized personnel can enter.
- Design distributed reports so they do not reveal password or trunk access code information.

Lucent Technologies Fraud Intervention

If you *suspect you are being victimized* by toll fraud and you need technical support or assistance, call Technical Service Center Toll Fraud Intervention Hotline at **1 800 643-2353**.

Related Documentation

For additional information about securing against toll fraud, refer to the following document:

Document #	Document Title
555-025-600	BCS Products Security Handbook

In addition, the following manuals may provide helpful information while installing and using the 8400B Plus Data Module. Since each user may have different equipment and software preferences or availability, only generic titles are given for the manuals.

If you are using a terminal device other than a PC:

User's guide for your terminal device. You may need information about the configuration and capabilities of your terminal device from that manual during the installation and preliminary operation of the 8400B Plus Data Module.

If you are using a PC as your terminal:

User's guide for Microsoft® MS-DOS®. You may need this reference for explanations of commands used by your PC to install, configure, and run your PC communications package.

User's guide for your PC communications package. You may need this guide for information on how to configure your terminal emulation software to access the 8400B Plus Data Module.

Important Safety Instructions

When using your equipment, basic safety precautions, including the following, should always be followed to reduce the risk of fire, electric shock, and injury to persons:

- Read and understand all instructions.
- Follow all warnings and instructions marked on the product.
- This product can be hazardous if immersed in water. To avoid the possibility of electric shock, do not use when you are wet. If you accidentally drop it into water, do not retrieve it until you have first unplugged the power cord from the alternating current (AC) outlet, the line cord from the modular wall jack, and all interconnecting cords from the terminal equipment. Do not plug the cords back in until the product has dried thoroughly.
- Avoid touching the product during electrical storms in your immediate area. There is a remote risk of electric shock from lightning. Even though protective measures may have been installed to limit electrical surges from entering your business, absolute protection from lightning is impossible.
- Never push objects of any kind through housing slots as they may touch hazardous voltage points or short out parts that could result in a risk of electrical shock. Never spill liquid of any kind on the product.
- Disconnect the cords on this product before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.
- Slots and openings in the housing and the back or bottom are provided for ventilation to protect it from overheating; these openings must not be blocked or covered. The openings should never be blocked by placing the product on a rug or other similar surface. This product should never be placed near or over a radiator or heat register. This product should not be placed in a built-in installation unless proper ventilation is provided.
- This product should be operated only from the type of power unit indicated in this manual. If you are not sure of the type of power supply being used, contact a qualified service person.

- Do not allow anything to rest on the power cord. Do not locate this product where the cord will be abused by persons walking on it.
- Do not overload wall outlets and extension cords as this can result in the risk of fire or electric shock.
- Disconnect the cords on this product and refer servicing to qualified service personnel under the following conditions:
    a. When the power supply cord or plug is damaged or frayed.
    b. If liquid has been spilled into the product.
    c. If the product has been exposed to rain or water.
    d. If the product does not operate normally by following the operating instructions.
    e. If the product has been dropped or the housing has been damaged.
    f. If the product exhibits a distinct change in performance.

SAVE THESE INSTRUCTIONS

When you see this symbol on the product, refer to the instruction booklet packed with the product for more information before proceeding.

Introduction

1

This chapter discusses the basic operating features of the 8400B Plus Data Module and describes the external indicators and connectors.

The 8400B Plus Data Module is a new version of the 7400B Plus Data Module and has been designed explicitly to work with two-wire DEFINITY Digital Communications Protocol circuits. It is fully compatible with the 7400B Plus and supports all of its functionality and applications.

Overview

Congratulations on the addition of the Lucent Technologies 8400B Plus Data Module. Following our tradition of excellent quality and high reliability, we have designed this new 8400B Plus Data Module with the latest advances in telecommunications technology.

The 8400B Plus Data Module is a full-duplex asynchronous data module. It provides integrated voice-data communications at the desktop over standard twisted-pair wiring. At the desk, the 8400B Plus Data Module provides asynchronous communication speeds ranging from 300 bps to 19.2 Kbps. The 8400B Plus Data Module's ability to emulate a Hayes® compatible modem interface makes it compatible with many standard PC communications packages that use Hayes command sets. In addition, the 8400B Plus Data Module provides a voice dial capability that allows you to initiate voice calls from

a personal computer (PC) using industry-standard ‘‘auto-dialer’’ PC communications packages.

The 8400B Plus Data Module is a data service link between a Data Terminal Equipment (DTE) device, a two-wire telephone, and a Lucent Technologies DEFINITY® Communications System G3V2 or later.

NOTE:
Unless a specific DTE device is intended, the words *terminal device* shall be used throughout this guide to represent any applicable DTE device, including a dumb terminal, or a PC with an appropriate communications package.

Features

A terminal device is connected to the 8400B Plus Data Module using a standard Electronics Industries Association EIA-232-D Connector cord and, if needed, the supplied M9/F25 Adapter. The M9/F25 Adapter converts a 25-pin interface to a 9-pin interface, adhering to the Electronics Industries Association/ Telecommunications Industry Association EIA/TIA-574 standard. A Digital Communications Protocol (DCP) interface (using a type D8W modular telephone cord) is used to connect the 8400B Plus Data Module to the digital PBX.

The 8400B Plus Data Module may be optioned for use either with or without a telephone. In the stand-alone case, the 8400B Plus Data Module supports data service only. Otherwise, the 8400B Plus Data Module provides simultaneous data and voice service. The 8400B Plus Data Module works with all DCP voice terminals that support two-wire operation (such as the 8400 series voice terminals) to provide simultaneous data and voice service.

The voice dial feature allows you to dial a voice call without touching the telephone. Depending on your communications package, you may also store telephone numbers on a PC and recall them for dialing, log phone calls for easy billing, and take notes for later reference during a telephone conversation.

In addition, the 8400B Plus Data Module can be used to automatically turn on the speakerphone of the voice terminal when a voice call is dialed from your terminal device.

Additional features of the 8400B Plus Data Module include the following:

- nonvolatile, read-write memory for storing installation options, two data options profiles, and up to four telephone numbers
- an AT command interface that emulates a Hayes 2400 Smartmodem™ and supports the following:
  - — storage of the wait time for carrier detect interval (S-register S7)
  - — voice call origination using the ATDP command
- automatic speed and parity adjustment
- even, odd, mark, space or no parity
- automatic data throughput adjustment
- power-up self-test
- local and remote loopback tests with test duration timers
- voice terminal powered by the PBX is not affected if AC power is removed from the 8400B Plus Data Module

Physical Description

The 8400B Plus Data Module is housed in a black casing, approximately 5" x 7.75" x 1.5". Its name appears on the underside of the unit. The external features of the front and rear panels and the separate power supply units are described in this section.

Front Panel

The front panel of the 8400B Plus Data Module is shown in Figure 1-1. One red light emitting diode (LED) and one green LED on the front panel indicate the status of the set during normal operation, and the result of self-tests when initially powered.

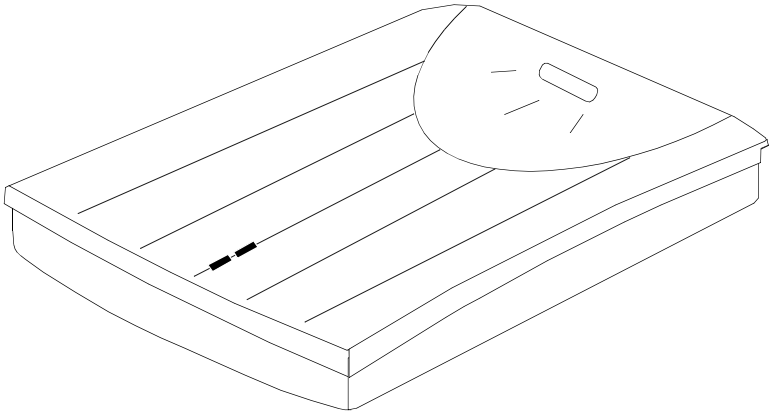

Figure 1-1. Front Panel of the 8400B Plus Data Module

Rear Panel

The rear panel of the 8400B Plus Data Module is shown in Figure 1-2, and the connectors located on the rear panel are described in Table 1-1.

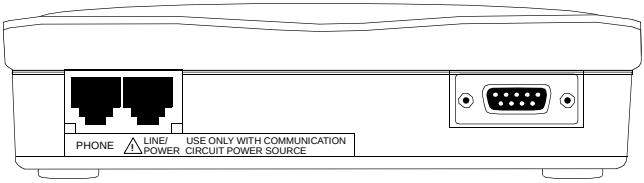

Figure 1-2. Rear Panel of the 8400B Plus Data Module

Table 1-1. Rear Panel Connector Descriptions

Connector	Description
PHONE	This connector accepts one end of the D8W telephone line cord used to connect a two-wire voice terminal to the 8400B Plus Data Module.
LINE/ POWER	This connector accepts one end of the D8W telephone cord that connects between the 8400B Plus Data Module and either: ■ a PBX wall jack already powered by a closet supply, or ■ a power supply, which is connected to the PBX wall jack.
EIA CONNECTOR INTERFACE	This unlabeled connector provides an interface between the 8400B Plus Data Module and the terminal device. ■ If the communications port on the terminal device is a 9-pin interface, use a cord with DB9 male connectors on each end to connect the Data Module to the terminal device. ■ If the communications port on the terminal device is a 25-pin interface, use a 25-pin EIA-232-D cord, plus the supplied M9/F25 Adapter to connect the Data Module to the terminal device.

Power Supply Unit

A Lucent Technologies power supply unit is shipped with each 8400B Plus Data Module. This unit connects to a grounded AC outlet, and provides a connection between the PBX wall jack and the 8400B Plus Data Module. The power supply unit provides the necessary operating voltages for the 8400B Plus Data Module.

CAUTION:
Use the 8400B Plus Data Module only with an approved communication circuit power source.

CAUTION:
Make certain that the AC outlet to which you connect the power supply is unswitched (for example, not controlled by a wall switch or light dimmer).

Instructions for installing the power supply unit are provided in ‘‘Hardware Installation’’ on page 2-8.

Installation

2

This chapter describes the equipment required for installing the 8400B Plus Data Module, and outlines procedures for preparing it for operation. If you are using the 8400B Plus Data Module with a PC, you will be ready to use a PC communications package after reading this chapter. If you are using the 8400B Plus Data Module with a terminal, printer, or host, or you want to learn about the AT interface and operations, read this chapter, and then continue to Chapter 3.

About the Terminal Device

The 8400B Plus Data Module operates with any asynchronous data terminal device that has either an EIA-232-D or RS-232-C interface. If you are using a PC as your terminal, you will need a suitable PC communications package. EIA Connector cord and PC communications package requirements are described in this chapter.

You must set the appropriate configuration options *before* connecting the 8400B Plus Data Module to a printer or plotter. To do this, connect a data terminal or PC to the EIA Connector Interface on the 8400B Plus Data Module, change and store the necessary configuration parameters, remove the data terminal or PC, and then connect the printer or plotter. The configuration parameters used for this type of operation are described in ‘‘Remote Site Use’’ on page 3-13.

Selecting the Correct Installation Procedure

The 8400B Plus Data Module is available in two configurations. Before you can successfully install the data module, you must ascertain which configuration you have. Refer to Figure 2-1 (on page 2-3) for an illustration of the components included with each configuration.

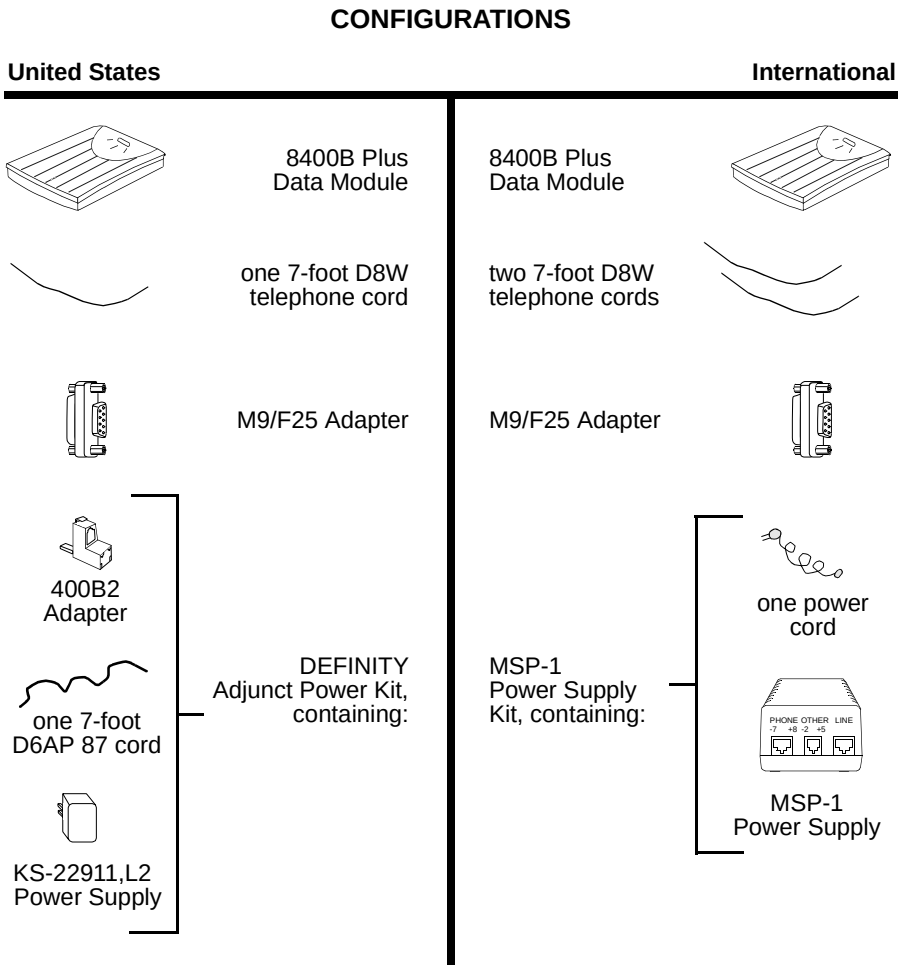

Figure 2-1. Components of the US Configuration and the International Configuration

What You Need

To install and operate the 8400B Plus Data Module, you will need the following items:

- an asynchronous data terminal or PC with a terminal emulation program and EIA cord
- (optional) a two-wire DCP voice terminal with D8W cord

Figure 2-2 illustrates a standard US Configuration, using a telephone and separate power supply.

Figure 2-3 illustrates a standard International Configuration, using a telephone and separate power supply.

The US Configuration may be installed using the Lucent Technologies 1145A or Lucent Technologies 1145B1 closet power supply. The International Configuration may be installed using the Lucent Technologies 1145B1 closet power supply. Both configurations are shown in Figure 2-4. This type of installation eliminates the need for the separate power supply.

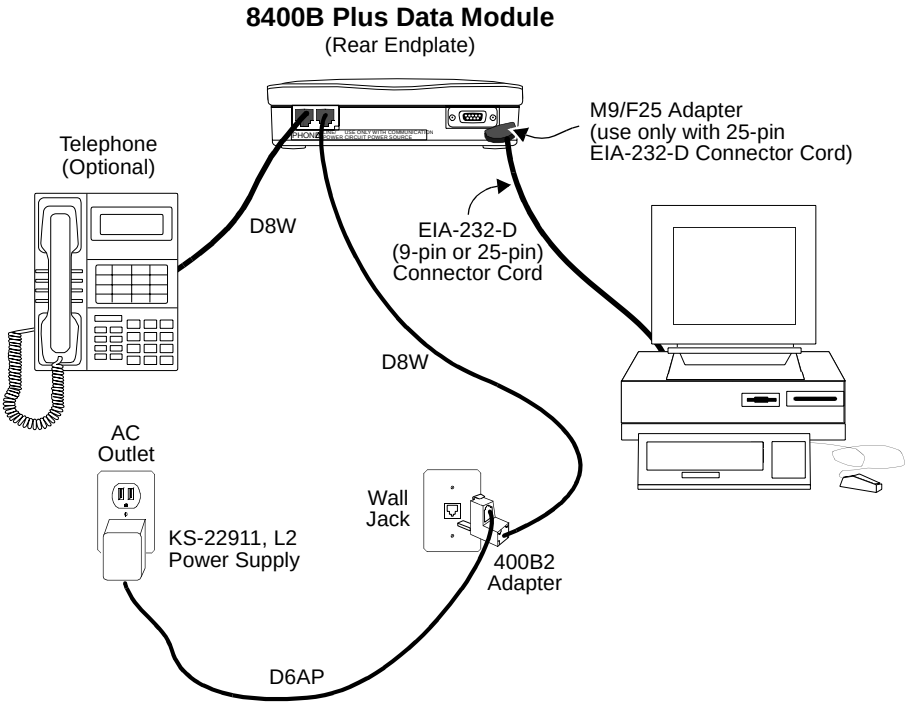

Figure 2-2. Typical Installation of the US Configuration, including Telephone and Separate Power Supply

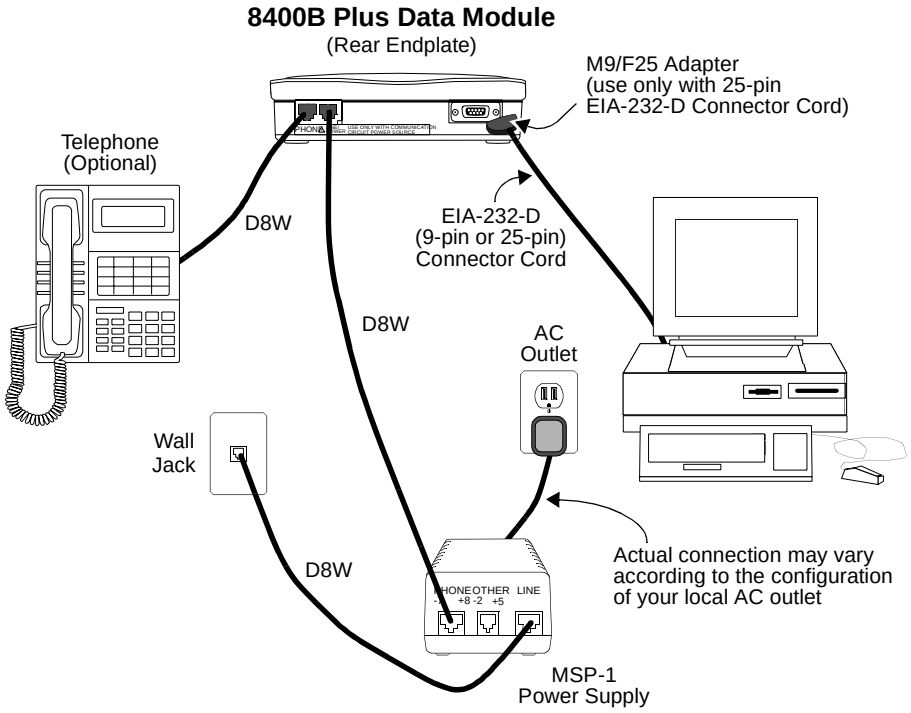

Figure 2-3. Typical Installation of the International Configuration, including Telephone and Separate Power Supply

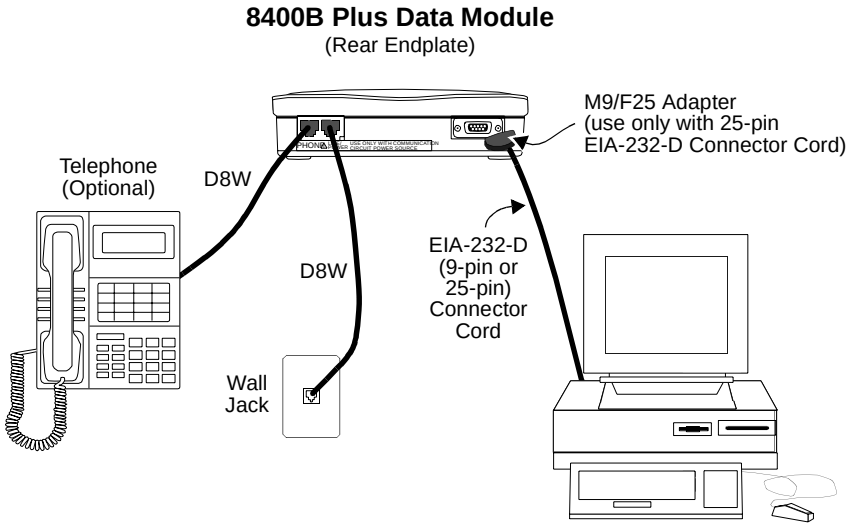

Figure 2-4. Typical Installation of the US Configuration or International Configuration, including Telephone and Closet Power Supply

Selecting an EIA Connector Cord

The standard EIA-232-D Connector cord (already supplied with your terminal or PC) may be used with the M9/F25 Adapter, to connect your terminal or PC to the 8400B Plus Data Module.

- If the communications port on the terminal device is a 9-pin interface, use a Connector cord with DB9 male connectors on each end to connect the Data Module to the terminal device.
- If the communications port on the terminal device is a 25-pin interface, use a 25-pin EIA-232-D Connector cord, plus the supplied M9/F25 Adapter to connect the Data Module to the terminal device.

The most common EIA-232-D Connector cords are supplied with a male connector at both ends. If you have this type of cord and the EIA-232-D port on your terminal device is a male connector, you can use an adapter commonly referred to as a “gender changer.” Otherwise, obtain an EIA Connector cord that has the appropriate gender connector at each end to fit your application needs.

Selecting DCP Cords

One or more 7-foot D8W cords are supplied with your 8400B Plus Data Module. Use the supplied cord, or obtain the appropriate length D8W telephone cord. If you are using the *With Telephone* option (see ‘‘With Telephone’’ on page 2-12), you will need the D8W telephone cord (already supplied with your telephone) to connect between the 8400B Plus Data Module and your telephone.

Hardware Installation

This section outlines procedures for connecting the EIA Connector cord and M9/F25 Adapter, installing the power supply, and connecting the D8W telephone cord(s).

⚠ CAUTION:
To avoid possible shock hazards and damage to the equipment, you should perform the installation steps in the order given.

Connecting the 8400B Plus Data Module to the Terminal

Use the EIA Connector cord and, if necessary, the M9/F25 Adapter to connect the 8400B Plus Data Module to the terminal device.

1. Connect one end of the Connector cord into the communications port on the terminal device. Tighten all retaining screws.

2. If the Connector cord has 25 pins:
    a. Plug the remaining end into the 25-pin portion of the M9/F25 Adapter.
    b. Plug the 9-pin portion of the M9/F25 Adapter into the EIA Connector Interface on the rear panel of the 8400B Plus Data Module. Tighten all retaining screws.
3. If the Connector cord has 9 pins, you do *not* need the M9/F25 Adapter:
    a. Plug the remaining end into the EIA Connector Interface on the rear panel of the 8400B Plus Data Module. Tighten all retaining screws.

Connecting the 8400B Plus Data Module to the PBX Wall Jack

Use the supplied DCP-type D8W telephone cord(s) to connect the 8400B Plus Data Module to the PBX wall jack, and to the separate power supply if necessary:

CAUTION:
Make certain that the AC outlet to which you connect the power supply is unswitched (for example, not controlled by a wall switch or light dimmer).

NOTE:
Since the 8400B Plus Data Module does not have a power on/off switch, the unit will power on as soon as the power supply is connected to an active AC outlet.

1. Insert either end of the first D8W telephone cord into the connector labeled *LINE/POWER* on the rear panel of the 8400B Plus Data Module.

2. If you are installing the US Configuration, and using the separate power supply provided with your 8400B Plus Data Module:
    a. Plug the 400B2 Adapter into the PBX wall jack.
    b. Plug the remaining end of the first D8W telephone cord into the bottom connector on the 400B2 Adapter.
    c. Plug one end of the D6AP cord into the power supply unit.
    d. Plug the other end of the D6AP cord into the top connector on the 400B2 Adapter.
    e. Plug the power supply unit into a 120 VAC, 60 Hz outlet.
3. If you are installing the International Configuration, and using the separate power supply provided with your 8400B Plus Data Module:
    a. Insert the remaining end of the first D8W telephone cord into the connector labeled *PHONE* on the power supply.
    b. Insert one end of the second D8W cord into the connector labeled *LINE* on the power supply.
    c. Insert the remaining end of the second D8W cord into the PBX wall jack.
    d. Plug the power supply cord into the power supply unit.
    e. Plug the other end of the power supply cord into an appropriate AC outlet. If the power supply cord provided with the MSP-1 Power Supply is *not* compatible with your AC outlet, you may either:
        1. use an adapter to conform to local blade arrangement, or
        2. use a replacement cord if an appropriate adapter is not available.
4. If you are using a closet power supply instead of the separate power supply, insert the remaining end of the first D8W telephone cord into the PBX wall jack.

Connecting a Telephone

If you are using the *With Telephone* option of the 8400B Plus Data Module (voice and data), install the telephone and any connected adjunct equipment as follows:

1. Insert either end of the remaining D8W telephone cord into the line jack on your two-wire telephone.
2. Insert the other end of the telephone cord into the jack labeled *PHONE* on the rear panel of the 8400B Plus Data Module.

NOTE:
See ‘‘Installation Options’’ on page 2-12 for instructions to select the *With Telephone* installation option.

NOTE:
If your voice terminal has data capabilities, those data features are not supported while the voice terminal is connected to the 8400B Plus Data Module.

Initial System Checks

The following sections describe procedures for initially checking out your hardware and any required software. It is assumed at this point that your PC communications package has been properly installed and is ready for use. (See ‘‘Selecting PC Communications Packages’’ on page 2-21 for guidelines when selecting your PC communications package.)

NOTE:
PC communications software is required only if you are using a PC as your terminal device. A dedicated data terminal does not need PC communications software.

Installation Options

Seven installation options are determined by the value entered in S-register S24. The factory-default settings of these installation options are correct for the majority of applications. Check the default values, listed in Table 2-1, to determine whether you need to make any changes.

NOTE:
Changes to these installation options will not affect the factory-default configuration. Conversely, loading the factory default configuration (using the AT&F command) will not affect these installation options. For additional information on the factory-default configuration, refer to page A-24.

With Telephone

This option is set, by default, for *Yes.* This permits operation with an associated voice terminal and enables simultaneous data and voice calls over the same line from the PBX. When the 8400B Plus Data Module is optioned for operation with a telephone, it must be connected to a two-wire DCP voice terminal. Data service is provided directly from the 8400B Plus Data Module, and any data features that the voice terminal offers cannot be used.

Setting this option to *No* permits the 8400B Plus Data Module to offer only data service between a terminal device and a remote system.

NOTE:
If the *With Telephone* option is selected a telephone *must* be connected to successfully complete a data call. If a telephone is not connected, no data calls can be made. If the telephone is disconnected during an active data call, the data call will also be disconnected.

NOTE:
A change in the setting of this option becomes effective when the 8400B Plus Data Module is powered on after being powered off. The setting of this option cannot be changed arbitrarily. It must agree with how the PBX

line is administered. Check with your telecommunications manager to administer the line for simultaneous voice and data or data service required.

US Companding

This option is set, by default, for *Yes*. Leaving this default permits the 8400B Plus Data Module to digitize voice signals according to the Mu-Law standards commonly used within the United States.

Setting this option to *No* requires the 8400B Plus Data Module to digitize voice signals according to the A-Law standards commonly used outside of the United States.

NOTE:
A change in the setting of this option becomes effective immediately.

Telephone Provides Dialing

This option is set, by default, for *Yes*. Leaving this default permits the 8400B Plus Data Module to use the telephone's DTMF dialing circuits to perform the dialing function. This setting also permits the telephone to annunciate the touch-tones.

Setting this option to *No* requires the 8400B Plus Data Module to perform the dialing function using its internal DTMF dialing circuit. The *No* setting does not allow touch-tones to be annunciated.

NOTE:
A change in the setting of this option becomes effective immediately.

Disable Data Metering Feature

This option is set, by default, for *Yes*. This requires the 8400B Plus Data Module to adjust its transfer speed to match the transfer speed of the remote system. The *CONNECT xxxx* message is displayed to indicate the transfer speed selected when the connection is made.

Changing this option to *No* allows the user to set up a call to a remote end that is running at a slower speed than the local data module, without having to lower the speed of the terminal. The *CONNECT xxxx* message will always indicate the speed of the local data transfer. The 8400B Plus Data Module performs the speed conversion and uses the Clear to Send (CTS) lead to flow-control the user's terminal if it is sending too much data too fast.

NOTE:
If you are using a PC with a communications package, or a dedicated terminal that does not support CTS control, you cannot make file transfers with the data metering feature enabled.

NOTE:
A change in the setting of this option becomes effective immediately when the 8400B Plus Data Module is in the idle mode or as soon as it is returned to the idle mode. The 8400B Plus Data Module is in idle mode any time that it is *not* in test mode or connected to an active data call.

Immediate Speakerphone Activation

This option is set, by default, for *Yes*. This permits the speakerphone (if available) to be activated before dialing, and allows the user to hear the dial-tone and touch-tones when the *Telephone Provides Dialing* option is set to *Yes*. (See ''Telephone Provides Dialing'' on page 2-13.)

Setting this option to *No* causes the speakerphone to be activated after dialing. The user can still hear the far-end ringing and answering.

NOTE:
This option applies only to voice-dial calls, and is only valid when the *Automatic Speakerphone Activation* option (see below) is set to *Yes*.

Automatic Speakerphone Activation

This option is set, by default, for *Yes*, permitting automatic activation of the speakerphone when you use your terminal to dial a voice call.

Setting this option to *No* causes the 8400B Plus Data Module to disable the automatic speakerphone feature, and necessitate the use of a handset or manual speakerphone activation.

This option has no effect if the voice terminal does not have a speakerphone.

When *Immediate Speakerphone Activation* and *Automatic Speakerphone Activation* are set to *Yes*, the 8400B Plus Data Module automatically activates the speakerphone at the beginning of the voice call so you can hear dial-tone and touch-tones.

NOTE:
To enable this feature, the Telephone Provides Dialing option must also be set to *Yes*.

When *Immediate Speakerphone Activation* is set to *No* and *Automatic Speakerphone Activation* is set to *Yes*, the activation of the speakerphone is delayed until dialing is complete.

Disable Busyout Feature During Local Loopback Test

This option is set, by default, for *Yes*. The 8400B Plus Data Module will not busyout the DCP line while performing a Local Loopback Test or Local Loopback Self-Test.

Changing this option to *No* allows the 8400B Plus Data Module to busyout the DCP line when either the Local Loopback or Local Loopback Self-Test mode is entered. This will cause a busy signal when the set is called. The busyout condition is released when the test ends.

NOTE:
A change in the setting of this option becomes effective immediately when the 8400B Plus Data Module is in the idle mode or as soon as it is returned to the idle mode. The 8400B Plus Data Module is in idle mode any time that it is *not* in a test mode or connected to an active data call.

Changing Installation Options

All seven installation options are set in S-register S24 via a number that represents their collective value.

- To accept the default value of *Yes* for all options, leave the value of 0 (zero) in S-register S24.
- To specify *No* for only one of the options, enter its value (see Table 2-1) in S-register S24. For example, to change *Automatic Speakerphone Activation* to *No*, enter *64* in S-register S24.
- To specify *No* for two or more options, add together the value for each of those options (see Table 2-1), and enter the total in S-register S24. For example, to set *With Telephone* to *No* and *Disable Data Metering Feature* to *No*, enter *17* in S-register S24.

Table 2-1. Installation Option Defaults and Values

Option Name	Default	Value To Select "No"
With Telephone	Yes	1
US Companding	Yes	2
Telephone Provides Dialing	Yes	4
Disable Data Metering Feature	Yes	16
Immediate Speakerphone Activation	Yes	32
Automatic Speakerphone Activation	Yes	64
Disable Busyout Feature During Local Loopback Test	Yes	128
Total, and enter value in S24	➜	

To adjust the installation options, perform the following steps.

1. Using Table 2-1, determine the total value to be entered in S-register S24.
2. Check the current value of S-register S24 by typing ATS24? ENTER.
3. If the desired value (ascertained in Step 1) does not match the current value (ascertained in Step 2), change the value of S-register S24. To do so, type ATS24=xxx, where *xxx* is the desired value of S-register S24. Press ENTER.

LED Indications

Two LEDs are located on the top of the 8400B Plus Data Module. One LED is red, and the other LED is green. These indicate the status of the set during normal operation, and the result of self-tests when the unit is initially powered.

When power is first applied to the 8400B Plus Data Module, the unit performs a self-test to verify that it is in working order. During the self-test, both LEDs will remain lit. When the self-test is complete, the green LED will turn off.

- If self-test passed, the red LED will remain on. This indicates that your 8400B Plus Data Module is installed and READY for data communications operation.
- If self-test failed, the red LED will flash three times, and then remain on. This indicates a defective unit. Call the Lucent Technologies Technical Service Center at 1 800 242-2121.

Table 2-2 lists all possible LED indications. Also refer to Chapter 4 for troubleshooting guidelines.

Table 2-2. LED Indication Summary

Status of Unit	Green LED	Red LED	Description
Self-Test	On	On	When the unit is first powered, this indicates it is performing a self-test. When the self-test is complete, the green LED will turn off. If self-test passed, the red LED will remain on. If self-test failed, the red LED will flash three times, and then remain on. This indicates a defective unit. Call the Lucent Technologies Technical Service Center at 1 800 242-2121.
Idle	On	On	Following the initial power-up of the unit, this indicates that the 8400B Plus Data Module is idle.
Other Test Modes	Flash*	Flash*	This indicates the unit is in test mode. For information regarding test mode, refer to Appendix D.
Memory Error Mode	Off	Flash*	This indicates a defective unit. Call the Lucent Technologies Technical Service Center at 1 800 242-2121.
Switch Link Down	Wink†	Inverted Wink ‡	The unit is unable to communicate with the PBX. Restore the connection between the 8400B Plus Data Module and the PBX wall jack.
Phone Link Down	Inverted Wink‡	Wink†	The unit is unable to communicate with the telephone. Restore the connection between the 8400B Plus Data Module and the telephone. If no telephone is connected, change the *With Telephone* installation option to *No*.

Table 2-2. LED Indication Summary — *Continued*

Status of Unit	Green LED	Red LED	Description
Idle	Off	On	This is the unit's normal mode if no active data call exists. The transmission of a character on the Send Data lead will cause the red LED to flash OFF for 100 ms. The transmission of a character on the Receive Data lead will cause the green LED to flash ON for 100 ms. The transmission of a continuous stream of characters, on the Send Data or Receive Data leads, will cause its LED to flash OFF and ON at 100 ms intervals.
Incoming Call	Flash*	On	This indicates an incoming call.
Active Data Call	On	On	This indicates an active data call. The transmission of a character on the Send Data lead will cause the red LED to flash OFF for 100 ms. The transmission of a character on the Receive Data lead will cause the green LED to flash OFF for 100 ms. The transmission of a continuous stream of characters, on the Send Data or Receive Data leads, will cause its LED to flash OFF and ON at 100 ms intervals.

* A *Flash* is a repeating pattern of 500 ms ON and 500 ms OFF.

† A *Wink* is a repeating pattern of 750 ms ON and 250 ms OFF.

‡ An *Inverted Wink* is a repeating pattern of 250 ms ON and 750 ms OFF.

Selecting PC Communications Packages

The purpose of PC communications software is to allow your PC to operate as an asynchronous voice-data communications terminal. Of the many software packages available, all perform essentially the same functions, but often in significantly different ways.

If you do not already have a PC communications package, consult with an experienced user for advice on selecting software to suit your voice-data communications needs. The following, though not required, are a few helpful features that you may wish to look for in the software you select:

- **Local mode.** Also called *terminal mode*, *dumb terminal mode*, or *chat mode*, this feature allows you to issue AT commands to the 8400B Plus Data Module to configure its options.
- **Dialing directory.** This feature allows you to store several frequently called numbers, often along with configuration of the data options needed for completing the connection.
- **Auto-dialer software**. This feature allows you to automate the process of dialing a voice call without touching the telephone. The following three basic types of auto-dialer software are available:
  - **Phone Management** supports call log and note taking
  - **DOS Utilities** typically supports auto-dial capabilities
  - **Personal Information Managers** (PIM) supports automated calendars, databases, time lines, and pert charts
- **Predefined data option profiles.** Some programs include completely defined data option profiles (also called configuration profiles) for popular modems. If available, select the option profile for the Hayes Smartmodem 2400.
- **Command files.** These files, also called *script files*, allow you to define a group of commands that may be executed for automatically logging into specific remote devices.

If You Are Using a PC

PC communications packages provide the capability of configuring the 8400B Plus Data Module automatically. When using a PC communications package with the 8400B Plus Data Module, there are two items to note:

1. The PC communications package should be configured to work with a Hayes Smartmodem 2400 or Hayes compatible modem.
2. The dialing method of the PC communications package should be set to *Tone* for data calls and *Pulse* for voice calls.

Many PC communications packages provide the possibility of writing script or command files. These files can then be run to execute a sequence of commands that will configure your system, or even provide an automatic log-on procedure for a particular remote end device. Review the documentation for your PC and PC communications package. Once you understand the PC communications package well enough, you will be ready to begin using it with the 8400B Plus Data Module.

Since there is such a diversity of functionality among the many PC communications packages available, refer to the user's manual of the package for specific details about its use.

For more information about the AT interface and operation of the 8400B Plus Data Module, refer to Chapter 3.

If You Are Using a Dedicated Terminal

When a dedicated terminal is used with an 8400B Plus Data Module, you must control the operation of the 8400B Plus Data Module. In a way, you are acting as a PC communication package. To do this, you must understand the operation of the 8400B Plus Data Module. Refer to Chapter 3 for information on the configuration and operation of your 8400B Plus Data Module.

Configuration and Operation

3

This chapter describes how to change, store, and recall configuration parameters; outlines how to create and save custom configuration profiles; and discusses more advanced command usage with example command lines.

This chapter also provides some basics on the operation of the 8400B Plus Data Module, describes how to use a few AT commands that are essential for most voice-data communications operations, and then outlines a typical on-line session.

NOTE:
The commands for the 8400B Plus Data Module are referred to as *AT commands* because you must type the letters AT as the first characters on the line for most commands.

Operating Modes

Except when a test condition has been initiated, the 8400B Plus Data Module is always in one of two states: command mode or data mode. When power is first applied, the 8400B Plus Data Module initializes to command mode after self-test is complete.

In command mode, the 8400B Plus Data Module looks at everything you type on your keyboard. When you type in something that the 8400B Plus Data Module recognizes as a valid command with a valid parameter (if required), it

will execute the action requested. A valid command with an invalid parameter will produce the *ERROR* result code. An invalid command will also produce the *ERROR* result code, and is ignored. In data mode, everything you type is passed as data without interpretation by the 8400B Plus Data Module, except the *escape sequence*. The escape sequence, described in later paragraphs, provides a way of switching the 8400B Plus Data Module back to command mode without disconnecting a data call.

Issuing Commands

The following paragraphs describe the elements of a command line and how the 8400B Plus Data Module responds to a command line when it is issued.

AT Command Line Prefix

All command lines issued to the 8400B Plus Data Module must begin with the letters AT or at with the exception of the A/ command, which is discussed later. The command line prefix must be entered as either both uppercase or both lowercase letters (that is, at and AT will work, but aT and At will not).

The letters AT, also known as the **AT**tention command, alerts the 8400B Plus Data Module to expect one or more commands to follow. The 8400B Plus Data Module examines the command line prefix to determine the communications rate of the terminal equipment as well as its parity setting. The 8400B Plus Data Module automatically adjusts the speed and parity settings and uses the setting until another AT command is received, or until the 8400B Plus Data Module is powered down.

Formats supported by the 8400B Plus Data Module are shown in Table 3-1.

Table 3-1. Character Formats

Data Bits	Parity	Stop Bits
7	even or odd	1
7	mark or space	1
8	none	1

All of these parameters may be changed on the local terminal device as needed. The 8400B Plus Data Module will adjust to match the speed and parity of the local terminal device when it receives an AT command.

If you connect to a remote system and your screen shows a series of nonsense characters (also referred to as “garbage”), chances are that you need to adjust the speed or parity on the terminal to match the settings of the 8400B Plus Data Module, which has adjusted its speed to match the remote system.

Command Buffer

As you type in a command, each character is saved in a 40-character buffer. The AT prefix, spaces, and the ENTER at the end of the command line are not saved and do not add to the character count. If you try to type more than 40 countable characters on one line, the result code *ERROR* will be displayed on your terminal screen, and the command line will be ignored.

Command Line Set Up

A command line begins with the AT prefix, includes one or more commands, and finishes with a line termination character, usually issued by pressing the ENTER key. The factory-default line termination character is an ASCII carriage return.

If you make an error while typing a command line, you can send the backspace character, usually issued by pressing the BACKSPACE key, as often as needed to delete the error. However, as soon as you enter the AT prefix, the 8400B Plus Data Module immediately reads it and sets up for a command to follow. Hence,

you cannot delete the AT prefix once it is typed. The factory-default backspace character is an ASCII backspace.

Once you complete a command line by pressing ENTER, the 8400B Plus Data Module will try to interpret all characters on the command line as valid commands. If the 8400B Plus Data Module finds a character that is not a valid command, it will ignore the erroneous character and any remaining characters on the command line.

Command Acknowledgment

Commands are acted upon immediately and are acknowledged by a result code. Most commands are acknowledged by ***OK***. This assumes that the result codes are configured in the verbose form (command V1 is in effect), and are enabled (Q0 in effect). Another option for configuring result codes is the short or numeric form. These result codes are set by the V0 command, which would produce a 0 (zero) instead of the message ***OK***. A final option for result codes is to disable them (Q1). Refer to Appendix A for descriptions of the V and Q commands.

Several other result codes may appear on your terminal screen while the 8400B Plus Data Module is completing a call. The option selected by the X command controls which of these result codes may appear on the screen of your terminal (the X command is described in Appendix A). All result codes that may be returned by the 8400B Plus Data Module are shown in Table 3-2 and in Appendix E.

Table 3-2. Result Codes

Verbose Form	Numeric	Description
OK	0	Command accepted
CONNECT	1	Connection made at 300 bps **NOTE:** If command X0 is in effect, CONNECT means connection made at whatever speed both ends of the call agreed upon.
RING	2	Ring signal detected
NO CARRIER	3	Carrier signal not detected or lost
ERROR	4	Error in command line
CONNECT 1200	5	Connection made at 1200 bps
BUSY	7	Busy signal detected
CONNECT 2400	10	Connection made at 2400 bps
CONNECT 4800	11	Connection made at 4800 bps
CONNECT 9600	12	Connection made at 9600 bps
CONNECT 19200	14	Connection made at 19200 bps

Repeating a Command

As mentioned earlier, the command buffer contains the last completed command line. If you wish to repeat the previous command line without retyping it, type A/ without the AT command prefix and without pressing ENTER. This command is most useful when you have typed a command line to have the 8400B Plus Data Module dial a number, and it returns the result code *BUSY*. Use the A/ command to redial the number as often as you wish.

Sample Command Lines

This section presents a few sample AT command lines with explanations of the results they will produce.

EXAMPLE 1: Checking if your terminal is communicating with the 8400B Plus Data Module.

AT ENTER

NOTE:
Remember, the two characters of the AT command prefix must be typed as either both uppercase or both lowercase. That is, you can type either at or AT, but At or aT will not work.

If everything is operating properly, the command should appear on the screen as you type it, and the 8400B Plus Data Module should respond with ***OK***.

EXAMPLE 2: Using a time saver.

A/

The A/ command tells the 8400B Plus Data Module to repeat the last command line exactly. If you had issued the command to dial a number and the 8400B Plus Data Module returned the message *BUSY*, you could type the A/ command to try the number again.

NOTE:
The A/ command must be the only command on the command line, and you do *not* press ENTER to complete the line.

EXAMPLE 3: Changing data options.

```
AT E1 &D2 S0=5 ENTER
```

This command line is a command sequence that sets up the 8400B Plus Data Module to set the command echo option, the DTR option, and the automatic answer option. The commands set the following parameters:

- AT is the required command prefix.
- E1 causes characters entered from the keyboard to be echoed to the screen while in command mode.
- &D2 causes the 8400B Plus Data Module to hang up the call when the local terminal turns off DTR.
- S0=5 causes the 8400B Plus Data Module to enter automatic answer mode and answer incoming calls on the fifth ring.

Configuration Parameters

Values for configuration parameters are selected by using AT commands. For a description of all AT commands used by the 8400B Plus Data Module, refer to Appendix A.

Parameter Storage and Retrieval

Configuration parameter values include the option values selected by AT commands that require option values and the values stored in the S-registers. A set of configuration parameter values is called a profile. The 8400B Plus Data Module has four configuration profiles at any given time: one active, two stored, and one that permanently contains the factory-default values.

Unsaved changes to configuration parameters remain in effect until they are changed again, or until the 8400B Plus Data Module is disconnected from the AC power source. Before making or storing any changes, or checking changes that you have made, you can issue an AT command to view the values that are currently in the active profile and the two stored profiles.

The active profile contains the parameter values that are currently in effect. All parameter values can be changed, and most changes can be stored to one of the two profile storage locations by issuing an AT command. Another AT command recalls values from one of the two stored profiles into the active profile.

Factory-default parameter values are a selection of values that are appropriate for a wide number of applications. These values are stored permanently in read-only memory (ROM) and you can issue an AT command to recall them into the active profile at any time.

Commands to view, store, and recall configuration parameters are summarized in Table 3-3. The commands discussed in this section are described in greater detail in Appendix A. To determine whether a configuration parameter that affects a particular S-register can be stored in memory, refer to Appendix C.

Table 3-3. Commands to Store, Recall, and View Configuration Parameters

Command Line:	Action:
AT&V ENTER	Display current AT command settings and S-register values in the active profile and the two stored profiles (also displays the four stored telephone numbers, which are described in the section titled "Storing a Telephone Number" on page 3-11).
AT&W*n* ENTER	Store the configuration parameters in the active profile to one of the two storage locations, where *n* represents the desired location and may be 0 or 1.
ATZ*n* ENTER	Immediately reset the 8400B Plus Data Module and recall one of the two stored configuration profiles into active status, where n represents the desired profile and may be 0 or 1.
AT&Y*n* ENTER	Recall one of the two stored configuration profiles into active status when the 8400B Plus Data Module is powered on, where *n* represents the desired profile and may be 0 or 1.
AT&F ENTER	Recall the factory-default configuration settings into the active profile. Note that this command does not load the Installation Option factory default values into the active profile (S-register S24).

Data Operation

This section provides information on how to use the 8400B Plus Data Module for data calls.

From Data Mode to Command Mode and Back

An *escape sequence*, +++ , can be typed at any time during a data call to return temporarily to command mode. Your call does not disconnect, but data is not exchanged. Once you have "escaped" to command mode, the 8400B Plus Data Module returns ***OK*** to acknowledge that it has entered command mode (see "Command Acknowledgment" on page 3-4).

At this point, you can issue commands to the 8400B Plus Data Module. As long as the data call has not been disconnected, you can use the ATO command to return to data mode.

One other condition will cause the 8400B Plus Data Module to switch from data mode to command mode. If the PBX senses that the remote device has disconnected, it will disconnect the call to the 8400B Plus Data Module. The 8400B Plus Data Module will turn off the green LED, turn on the red LED if it is not already on, display a result code message on your terminal screen (such as *NO CARRIER*), and then return to command mode.

The escape sequence and all other commands discussed in this section are explained in Appendix A.

Dialing a Data Call

The dial command is issued to the 8400B Plus Data Module in the form ATDT*nnn...n*, where D is the dial command, T is the dial modifier (see Appendix B for more information on dial modifiers), and *nnn...n* represents the number you wish to dial. The command line can hold up to 40 characters, so you can usually precede the D with other commands on the same line.

The following is an example:

ATDT74768 ENTER

In the example, the command will cause the 8400B Plus Data Module to go off hook, dial the number, and then wait the period of time specified in S-register S7 for the call to be completed.

If the call cannot be completed, the 8400B Plus Data Module may disconnect and send the result code ***NO CARRIER*** or ***BUSY*** to your display screen. When a call is successfully completed, the 8400B Plus Data Module will send the result code ***CONNECT nnnn*** to your screen, where ***nnnn*** represents the speed of the 8400B Plus Data Module (for example, 1200).

NOTE:
The speed sent in the *CONNECT xxxx* message may not be the same speed used to dial the call. In this case, the terminal speed must be changed to match the new speed.

Storing a Telephone Number

The 8400B Plus Data Module is capable of storing up to four telephone numbers, each of which can contain up to 25 characters. Numbers stored in this way remain available indefinitely, even after the 8400B Plus Data Module has been powered off and then on again.

Table 3-4 describes the command lines used to store a telephone number, delete a number from storage, and dial a stored number.

NOTE:
Digits 0 through 9 and all letters a through z and A through Z may be part of the stored "number." Spaces and hyphens (-) may be used in the number when typing the command line. Spaces are not stored and do not add to the total count of characters in the stored number, but all other ASCII characters are stored and counted. Any ASCII character may be used, as long as it is acceptable to the PBX. A semicolon (;) character cannot be stored because it is used to delimit the end of the string being

stored so that additional commands can be entered on the same command line.

Table 3-4. Commands for Using Stored Telephone Numbers

Command Line:	Action:
AT&Z*m*=*nnn...n* ENTER	Store number *nnn...n* in location *m*, which is one of four locations designated by the numbers 0 through 3. For example: AT&Z2=918006245123 ENTER stores the number 918006245123 in number storage location 2.
AT&Z*m*= ENTER	Delete any number stored in location *m*, which is one of four locations designated by the numbers 0 through 3. For example: AT&Z2= ENTER deletes any number that may have been stored in number storage location 2.
ATDS=*m* ENTER	Dial the number stored in location *m*, which is one of four locations designed by the numbers 0 through 3. For example: ATDS=2 ENTER causes the 8400B Plus Data Module to dial the number stored in location 2.

Automatic Answering

The 8400B Plus Data Module can be set up to answer incoming data calls automatically. To initialize this option, type the command line:

ATS0=***nnn*** ENTER

where *nnn* is a decimal number in the range of 1 through 255, representing the number of rings to wait before answering. If *nnn* is 0 (the factory-default setting), the automatic answer feature is turned off.

Remote Site Use

The 8400B Plus Data Module can be used at a remote site as a dedicated service device to answer incoming data calls, send data to a remote end device, and then hang up. For example, you may wish to provide access to a printer from a remote site.

The following is a typical command line you might use for setting up this operation (spaces are used here for readability, but are not required):

AT &F &C1 &D2 E0 Q1 S0=1 &W0 &Y0 ENTER

Following the AT prefix, the commands in the example produce the following results:

- &F resets the options to the factory defaults.
- &C1 sets the Data Carrier Detect (DCD) circuit of the 8400B Plus Data Module to operate according to the EIA standard.
- &D2 sets the 8400B Plus Data Module to go on hook when an on-to-off transition is detected on the Data Terminal Ready (DTR) input, disconnecting the call.
- E0 turns off the echo.

- `Q1` turns off the result codes that would be the normal responses of the 8400B Plus Data Module to commands that it receives. (For example, the ***CONNECT*** message that is displayed when answering a call would interfere with the printer.)
- `S0=1` turns on the automatic answer feature and causes the 8400B Plus Data Module to answer an incoming data call on the first ring.
- `&W0` causes the current configuration to be stored in data profile storage location 0.
- `&Y0` selects the configuration stored in data profile storage location 0 to become the current configuration each time the 8400B Plus Data Module is powered on.

Refer to Appendix A for a complete description of each command used in this section.

Reset and Configuration Recall

Two commands are available for recovering from various data communications problems. You can reset the 8400B Plus Data Module and recall one of two stored profiles as the current configuration. The form for this command is as follows:

ATZ***n*** ENTER

where *n* is the number 0 or 1, representing the configuration profile to be recalled.

A second command allows you to recall the factory-default configuration if, for instance, you lose track of the active configuration changes you have made and need to start over. The form for this command is as follows:

AT&F ENTER

Sample Command Lines

This section presents a few sample AT command lines for data calls, along with explanations of the results they will produce.

EXAMPLE 1: Dialing a data call.

```
AT D T 18006245123 ENTER
CONNECT 2400
```

In the first line of this example:

- AT is the required command prefix.
- D is the dial command.
- T is the dial modifier for a data call. (This is not required, and may be omitted.)
- The remainder of the line is the telephone number.

NOTE:
The spaces between the commands and the telephone number are included only for readability and are not required. You may also insert hyphens (-) anywhere in the telephone number for increased readability.

In the second line of this example, the 8400B Plus Data Module returns a response indicating that a connection with the remote end device has been successfully completed at 2400 bps.

EXAMPLE 2: Dialing a data call outside your PBX domain with another option thrown in.

```
AT &F D 9 1 800 555-5555 ENTER
BUSY
```

In the first line of this example:

- AT is the required command prefix.
- &F tells the 8400B Plus Data Module to restore the factory-default configuration parameters.

- D is the dial command.
- 9 represents the access code required to dial a number outside your PBX domain.
- The remainder of the line is the telephone number.

In the second line of this example, the 8400B Plus Data Module indicates that it detected a busy signal, and the call is automatically disconnected.

A Sample On-Line Session

This section outlines how to perform a simple on-line session using the AT commands described in this chapter. For more information about all AT commands, see Chapter 3 and Appendix A.

Starting the Session

The following is a sample data call to a fictitious bulletin board service. If you know the number of a “real” bulletin board service, you might try an actual log on by using that number and following the suggestions in this session.

```
AT D 9-555-7575 ENTER
CONNECT 1200
```

The D command is used to dial the number of the bulletin board. Since the connection was made successfully, the 8400B Plus Data Module responded with a message that says the remote end connected and the data speed to be used is 1200 bps. If this does not match the speed of your terminal or PC, you must adjust the speed of the terminal or PC to 1200 bps.

The remote end may do nothing until you press a particular key a few times, usually ENTER. Typical of many data communications application programs, this sometimes required input lets the remote end determine whether you have connected with the correct communications parameters in effect.

Possible Display Problems

If the response from the remote end is unintelligible “garbage,” chances are that the speed or parity bit selection is incorrect. In this case, assuming that your terminal device allows, the parameters may be corrected without disconnecting the call. Otherwise, you must disconnect, correct the parameters, and then try the call again.

Disconnecting a Data Call

Most remote systems will have a command or menu selection for logging off. When you select the appropriate means, the remote system will disconnect or hang up. The PBX will disconnect the call and, after a moment, the 8400B Plus Data Module will send the following message to your display:

NO CARRIER

Alternatively, you can use the following disconnect procedure:

```
Selection: +++
OK
```

The prompt `Selection:` is simply a representation of how the remote system might ask you for your next command or menu selection. Type the escape sequence (default is +++) but do *not* press ENTER. (Pause before typing +++ , type +++ quickly, and then pause again after typing +++.) When the 8400B Plus Data Module responds with ***OK***, type the command line:

ATH ENTER

The PBX will disconnect from the remote end device, and the 8400B Plus Data Module will send the ***OK*** message to the terminal display.

Voice Operations

This section provides information on how to use the 8400B Plus Data Module for voice dialing.

NOTE:
The host PBX must be administered to support voice and data calls.

Using the 8400B Plus for Voice Dialing

The 8400B Plus Data Module is equipped with a voice-dial feature that allows you to place voice telephone calls from the attached terminal device. To place a voice call, just tell the 8400B Plus Data Module to use pulse dialing by including the P dial modifier. (For data calls, tell it to use tone dialing by including the T dial modifier.) If you fail to specify the type of dialing to be used for a call, a data call will be made.

If you have a speakerphone, the 8400B Plus Data Module will normally turn it on when a voice call is being dialed. You may option the 8400B Plus Data Module to inhibit the speakerphone or delay activating it until after dialing is complete by setting the appropriate installation options. For more information on installation options, see Chapter 2.

If your telephone does not have a speakerphone, you may lift the handset at any time before, during, or after the call is dialed.

Voice calls can be originated from the PC, but you must use the telephone to hang up a call.

Dialing Instructions

When a voice call is made using the PC, the telephone number should be given to the 8400B Plus Data Module in a single AT dial command as indicated in the example below.

```
ATD P 9,1 (908) 555-1212 ENTER
```

The P dial modifier must be included to tell the 8400B Plus Data Module that the call is a voice call. If an attempt to dial a voice call is made using more than one dial command on a command line, the first dial command will be accepted and the second dial command may be discarded. After dialing the call, the 8400B Plus Data Module automatically returns to the command mode.

A second voice call can be made from your PC by manually placing the first call on HOLD, and then entering a dial command for the second call. Any attempt to dial a second voice call while the first call is being dialed will be ignored.

Dialing Delay

To ensure that dialing does not begin before dial tone is received, dialing a voice call will be delayed by the time stored in S-register S6 (Wait Time Before Blind Dialing) and can be set to a maximum value of 255 seconds. The factory setting of two seconds for S-register S6 is adequate for most calls.

Dialing Pause

A pause for second dial tone is normally required for calls outside the PBX. This can be provided by including a comma between the outside line prefix (for example, 9) and the first digit of the telephone number to be dialed. The comma instructs the 8400B Plus Data Module, after dialing the prefix number, to pause a fixed time before dialing the first digit of the telephone number. The pause time is stored in S-register S8 (Duration of Delay For Comma Dial Modifier) and can be set for any value up to a maximum of 255 seconds. The factory setting of two seconds is adequate for most applications and should not be changed. If added delay is required, additional commas can be added to the number.

Sample Command Line

This section presents a few sample AT command lines for voice dialing, along with explanations of the results they will produce.

EXAMPLE 1: Dialing a voice call.

```
ATD P 9,1 9085551212 ENTER
OK
```

In the first line of this example:

- AT is the required command prefix.
- D is the dial command.
- P is the dial modifier required to initiate a voice call.
- 9 represents the access code required to dial a number outside your PBX domain.
- , (comma) is the dial modifier pause required for a second dial tone.
- 1 represents the code required to dial a number outside your area code.
- The remainder of the line is the telephone number.

EXAMPLE 2: Using the 8400B Plus Data Module as a touch-tone generator to dial a voice mail system and log-on to retrieve messages.

```
ATD P 8000,,3452#, 999# ENTER
```

- AT is the required command prefix.
- D is the dial command.
- P is the dial modifier required to initiate a voice call.
- 8000 represents the internal number for accessing the AUDIX voice mail system.
- ,, (two commas) introduce a double delay while the call is being established.
- 3452# is the extension for the messages you want to receive.

- , (one comma) introduces a single delay.
- 999# is the password for the above extension.

At this point you are in your voice mail system ready to send, receive, etc., messages.

EXAMPLE 3: Using the 8400B Plus Data Module to dial multiple calls.

AT D T 1 800 624-5123; D P 9, 555-1212 ENTER

- AT is the required command prefix.
- D is the dial command.
- T is the dial modifier required to initiate a data call.
- 1 represents the code required to dial a number outside your area code.
- 800 624-5123 is the remainder of the data call telephone number.
- ; (semicolon) returns you to the command mode.
- D is the dial command.
- P is the dial modifier required to initiate a voice call.
- 9 represents the access code required to dial a number outside your PBX domain.
- , (one comma) introduces a single delay.
- 555-1212 is the voice call telephone number.

Troubleshooting

4

This chapter describes procedures for troubleshooting most problems that may be encountered while installing, configuring, and operating the 8400B Plus Data Module.

How to Use This Chapter

Use the following guidelines to isolate and correct a problem:

1. Scan through the “Symptom” column in the chart to find the description that best describes the problem situation you have encountered.
2. In the “Problem” column, one or more problem descriptions is offered. Select the one that best describes the observable condition, or try each suggestion in turn until the trouble has been corrected.
3. Perform the task described in the “Solution” column. In cases where you are directed to type an AT command to correct the problem and the 8400B Plus Data Module is in the data mode, simply do the following:
    a. Type the escape sequence (+++) to enter command mode; the 8400B Plus Data Module will respond with ***OK*** or ***0*** (unless the Q1 option has been set to disable result codes).
    b. Type the suggested command line. If the solution suggests disconnecting the call, type the command line

        ATH ENTER

4. To return to data mode after using the escape sequence to enter command mode, type the command line

   ATO (ENTER)

Table 4-1. Troubleshooting Guidelines

Symptom	Problem	Solution
Both LEDs are off.	Power is off.	Check that the AC outlet is working. Check that the power supply unit is properly connected to the 8400B Plus Data Module and to the AC outlet.
The green LED is winking (750 ms on, 250 ms off), and the red LED is inverted winking (750 ms off, 250 ms on).	The 8400B Plus Data Module has lost communications with the PBX.	For the MSP-1 power supply, check that the D8W cord is connected between the *LINE/POWER* connector of the power supply and the PBX wall jack. For the KS-22911,L2 power supply, check that the 400B2 adapter is connected to the PBX wall jack. Note also that the line from the PBX must be properly administered for the 8400B Plus Data Module.
The red LED is winking (750 ms on, 250 ms off), and the green LED is inverted winking (750 ms off, 250 ms on).	The 8400B Plus Data Module has lost communications with the telephone.	Check that the D8W telephone cord is securely connected between the telephone and the *PHONE* jack on the 8400B Plus Data Module.
No dial tone is heard when the telephone handset is lifted. All call appearance LEDs on the telephone are off.	Incorrect option settings.	Change the *With Telephone* option to *Yes*.

Table 4-1. Troubleshooting Guidelines — *Continued*

Symptom	Problem	Solution
Call disconnects immediately after an attempt to connect; NO CARRIER may be displayed on the local terminal device; green LED turns off, red LED is on.	The speed of the far-end device is higher than the speed of the local terminal device.	Change the speed of the local terminal device to match that of the far-end device. If the speed of the far-end device is not known, set the local terminal device to the highest speed available.
	The far-end device is set up for half-duplex or synchronous operation.	The 8400B Plus Data Module cannot communicate with a far-end device that is operating half-duplex or synchronous. This problem can be resolved only if the far-end device can be reconfigured for full-duplex, asynchronous operation.

Table 4-1. Troubleshooting Guidelines — *Continued*

Symptom	Problem	Solution
Call disconnects immediately after an attempt to connect; BUSY or NO CARRIER may be displayed on the local terminal device; green LED turns off, red LED is on.	The far-end device is busy with another call.	Try the call again.
	The telephone number was dialed incorrectly.	Check the number of the far-end device that you wish to call and try the call again.
	The far-end device is not busy, but the PBX has restricted access to the called device.	This situation can only be resolved by having the PBX readministered to remove the access restriction.
	The value in S-register S7 does not allow enough time for the call to be completed.	Increase the value of S-register S7.

Table 4-1. Troubleshooting Guidelines — *Continued*

Symptom	Problem	Solution
The PC communications software indicates that the call has been disconnected, but the green LED is still on.	The 8400B Plus Data Module has ignored the on-to-off transition of the DTR lead.	From command mode, type the command AT&D2 (ENTER) to set the DTR lead option to disconnect on DTR lead transition from on to off. Alternatively, determine and use the command provided by the communications software to implement this change.
	The 8400B Plus Data Module has ignored the H (hang-up) command.	Ensure that after the escape sequence (+++) has been entered to switch the 8400B Plus Data Module to command mode, an adequate pause before and after the +++ is allowed before issuing the H command. In escaping to command mode with the result codes enabled, the 8400B Plus Data Module must be given time to return ***OK*** or ***0*** before it is ready to accept a command.
The speakerphone does not turn on when a voice call is dialed.	Incorrect option settings.	Change the *Automatic Speakerphone Activation* option to *Yes*.
The speakerphone turns on when a voice call is dialed, but dial tone and touch-tones are not heard.	Incorrect option settings.	Change the *Immediate Speakerphone Activation* option to *Yes*.

Table 4-1. Troubleshooting Guidelines — *Continued*

Symptom	Problem	Solution
The speakerphone turns on when a voice call is dialed, and a dial tone is heard, but touch-tones are not heard.	Incorrect option settings.	Change the *Telephone Provides Dialing* option to *Yes*.
Dial tone and voice sounds are distorted.	Incorrect option settings.	Change the *US Companding* option to *Yes* to enable Mu-Law companding (within the US), or to *No* to enable A-Law companding (outside of the US).
Data calls are dialed instead of voice calls.	Incorrect dial modifier is used with the ATD dial command.	Change the PC communications package to use **Pulse** dialing, or insert a P as the first digit of the telephone number.
Dialing begins before the dial tone is heard on a voice call.	Incorrect blind dial delay.	Check the value stored in S-register S6 by typing ATS6? ENTER ***nnn*** (system responds with value) ***OK*** Add 1 second to the above value by typing ATS6= (nnn+1) ENTER ***OK*** and try again.

Table 4-1. Troubleshooting Guidelines — *Continued*

Symptom	Problem	Solution
Dialing begins before the second dial tone is heard.	Incorrect dialing pause.	Insert a comma in the telephone number after the 9 (digit used for calls outside the PBX). ATDP9,555-1212 ENTER If the problem persists, insert another comma for a second pause. ATDP9,,555-1212 ENTER and try again. Check your PC communications package to make sure the commas are sent to the 8400B Plus Data Module along with the digits.
The 8400B Plus Data Module does not pause when a comma is inserted in a telephone number for a voice dial call.	The comma delay is set to 0 (zero).	Check your PC communications package to make sure a comma is a valid character. Type ATS8=2 ENTER to set the pause to 2 seconds.

Table 4-1. Troubleshooting Guidelines — *Continued*

Symptom	Problem	Solution
The green LED is flashing, and the red LED is on, but the 8400B Plus Data Module does not automatically answer the incoming call.	The automatic answer option is not enabled.	From the command mode, type `ATS0=1` (ENTER) to turn on the automatic answer feature. Set the value following the equal sign (`1` in the example) to the ring number on which you want the 8400B Plus Data Module to answer an incoming call. The automatic answer feature is turned off by setting this value to `0`.
	The automatic answer option is enabled, but the terminal device is not ready.	If the local terminal is a PC, configure the communications software to turn on the DTR lead, or set the 8400B Plus Data Module to ignore the DTR lead by typing `AT&D0` (ENTER)
Transmitted and/or received data contains errors.	Speed settings of the terminal device and the 8400B Plus Data Module are not the same.	Change terminal device speed to agree with the speed that was indicated in the *CONNECT nnnn* message.
	The local terminal device and the far-end device are configured for different parity settings.	Change the parity setting of the local terminal device to match that of the far-end device.
Far-end data errors occur only during file transfer with PC communications package.	PC does not support hardware flow control.	Disconnect the call, change the *Disable Data Metering Feature* option to *Yes*, reestablish the call, and try the file transfer again.

Table 4-1. Troubleshooting Guidelines — *Continued*

Symptom	Problem	Solution
Result codes are not displayed when commands are entered.	The display result codes option is turned off.	Turn on the display result codes option by typing ATQ0 (ENTER)
Numeric code returned when verbose message is preferred.	The result code format option is set to numeric form.	Change the result code format option to verbose form by typing ATV1 (ENTER)
Commands are displayed without error as they are typed (echoed), but the 8400B Plus Data Module does not respond to any command.	The local terminal device is set to a speed not supported by the 8400B Plus Data Module.	Set the terminal device for one of the supported speeds: 300, 1200, 2400, 4800, 9600, or 19200 bps.
The ***CONNECT*** message is sent without a speed indication, but the far-end device is not set at 300 bps.	The 8400B Plus Data Module is configured to display only the basic set of result codes (option X0).	Configure the 8400B Plus Data Module to send *CONNECT nnnn* messages for all speeds except 300 bps by typing ATX4 (ENTER)

Table 4-1. Troubleshooting Guidelines — *Continued*

Symptom	Problem	Solution
Characters typed on the keyboard are not displayed on the screen of the terminal device.	If the red LED flashes off but the green LED does not flash on when characters are typed, the command echo option is turned off.	Press ENTER to start a new command line, and then type ATEl ENTER to turn on the command echo.
	If the red and green LEDs do not flash when keys on the terminal are pressed, the terminal is not working, or the EIA Connector cord or adapter are not connected or are improperly wired.	Connect or replace the EIA Connector cord and/or adapter between the 8400B Plus Data Module and the local terminal device. If the problem persists, verify that the terminal is functioning correctly.
	The red LED flashes off and the green LED flashes on, but certain EIA signal leads are turned off.	Press ENTER to start a new command line, then type AT&S0&C0 ENTER to ensure that the DSR and RLSD EIA signal leads are turned on.
An AT prefix is typed, and it is displayed as AATT.	The terminal is optioned to display each typed character, and the 8400B Plus Data Module's command echo option is enabled.	Disable the command echo by entering ATE0. As you type the ATE0 command, AATTEE00 will appear, and the 8400B Plus Data Module will send the response code ***OK*** to your screen. The next command that you enter should appear in single characters.

AT Command Set

A

This appendix contains an explanation of each AT command accepted by the 8400B Plus Data Module. Labels used in the descriptions are defined as follows:

Table A-1. Accepted AT Command Labels

Label	Description
Command:	The command is shown as it should be typed. The command may be typed in uppercase or lowercase. Spaces may be typed between multiple commands on the same command line for readability, but the spaces are ignored by the 8400B Plus Data Module.
Function:	A brief, functional description of the command is provided here.
Type:	Type may be *immediate* or *configuration*. An immediate command causes the 8400B Plus Data Module to perform an action as soon as the command is sent (for example, go off-hook or dial a number). A configuration command modifies a configuration parameter during the current session.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Arguments:	Many commands accept or require a numerical argument. Whether an argument is required and the range of acceptable values for the argument is shown here.
S-Register:	The S-registers consist of 28 1-byte memory locations in the data module, designated as S0 through S27. The S-registers hold values for defining the current configuration of the 8400B Plus Data Module. Some commands modify a specific S-register, and some commands perform an action based on the current value stored in an S-register. Whether an S-register is modified or read by the current command is explained here.
Example:	A sample command line follows this label to demonstrate how the command may be used.
Comments:	An explanation of the example and any other information about the command not provided elsewhere is provided here. Additional commands may be typed on the same command line with the command currently under discussion, unless noted otherwise.
See Also:	Following this label are suggestions on where to look for more information about the current command and a listing of any other commands that may be used with or affect the use of the current command.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	+++
Function:	Escape sequence.
Type:	immediate
Arguments:	none
S-Register:	S2 and S12
Example:	+++
Comments:	The purpose of the +++ command is to provide a way to switch the 8400B Plus Data Module from on-line or data mode to command mode without disconnecting a data call that is in progress. As long as the call is not disconnected, you can return to the data mode with the O command. This is one of the two commands that does not require the AT prefix (A/ is the other one), and it is never followed by pressing ENTER . The value in S12 determines how long your keyboard should remain idle before entering the escape sequence, as well as the maximum allowable time between entering each character of the sequence. The character used in the escape sequence is determined by the value in S2 (default is ASCII 43, the plus sign).
See Also:	"From Data Mode to Command Mode and Back" on page 3-10, the O command on page A-14, S2 on page C-9, and S12 on page C-19.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	A
Function:	Go off-hook in Answer mode.
Type:	immediate
Arguments:	none
S-Register:	Bit 7 of S14 is set to 0.
Example:	ATA ENTER
Comments:	The A command causes the 8400B Plus Data Module to go off-hook in answer mode and attempt to answer an incoming call. The option set by the &D command and the contents of S0 and S1 are ignored when this command is issued.
See Also:	The &D command on page A-23, S0 on page C-7, S1 on page C-8, and S14 on page C-20.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	A/
Function:	Re-execute the last valid command line.
Type:	immediate
Arguments:	none
S-Register:	none
Example:	A/
Comments:	This is one of the two commands that does not require the AT prefix (+++ is the other one). To repeat the previously executed command line exactly, type A/ without pressing the Return or Enter key. This command cannot be combined with any other command.
See Also:	"Repeating a Command" on page 3-5.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	D
Function:	Dial a call.
Type:	immediate
Arguments:	The D command requires an ASCII character string to specify the telephone number to be dialed as follows: ■ For voice calls, the valid characters are limited to * and #, and digits 0 through 9. Voice dial commands with invalid characters are accepted and the invalid characters are ignored; only the valid characters are dialed. ■ For data calls, the character string may include any ASCII character with the following restrictions: — If the letter T (uppercase or lowercase) is typed as the first character following the D command, or as the first character of a stored number when AT does not follow the D command, the 8400B Plus Data Module will delete the character. For example, if you want your dial string to be the mnemonic “TEXAS,” you must type the T twice (the first T may be uppercase or lowercase), producing the command line: ATDT TEXAS ENTER

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Arguments — *Continued:*	The T following the D command will be discarded and the string “TEXAS” will be sent to the PBX as a dial mnemonic (the PBX must be administered to recognize this mnemonic as the representation of a number to be dialed). **NOTE:** Mnemonic dialing is valid for data calls only. ■ The PBX may interpret certain nonalphanumeric characters as commands and perform an unexpected action, if you did not intend to send the command to the PBX. Consult the documentation for your PBX to determine which characters may be interpreted as commands. ■ The dial modifier S=*n*, where *n* may be a number from 0 through 3, will cause the 8400B Plus Data Module to send the contents of its respective telephone number storage location to the PBX as the telephone number. For details on how to use this feature, refer to "Storing a Telephone Number" on page 3-11.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Arguments — *Continued:*	In addition to a telephone number, the following Dial Modifiers may be used with the dial command: P (Pulse) — used with a dial command to indicate a voice call. Must be the first character in the dial string or the stored telephone number. T (Tone) — used with the dial command to indicate a data call. Must be the first character in the dial string or the stored telephone number. A data call will be dialed if neither the P or T dial modifier is used. , (Comma) — may be used to provide a dialing pause for second dial tone. For voice calls, the pause interval is controlled by the setting of S-register S8. For data calls, the delay is controlled by the PBX. ; (Semicolon) — used to delimit a dial command from other commands that follow it on the same command line. The semicolon dial modifier causes the 8400B Plus Data Module to remain in command mode after the call is dialed. *S=n* — used to dial a telephone number stored with the &Zn=x command.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
S-Register:	Bit 7 of S14 is set to 1.
Example 1:	ATDP 9,1 201-555-1212 (ENTER)
Example 2:	AT &Z1=Texas (ENTER) ATDP 9, 1 201-555-1212;DTS=1 (ENTER)
Comments:	Dial modifiers can be combined in a dial command to perform a series of operations. In example 1, the P dial modifier is used to indicate that it is a voice call and the comma (,) is used to provide a pause for a second dial tone. **NOTE:** The 8400B Plus Data Module always returns to the command mode after dialing a voice call. In example 2, the mnemonic dial string Texas is first stored in nonvolatile memory location 1 and then used in conjunction with the S=1 dial modifier on the next command line to dial a data call after a voice call is dialed. The semicolon dial modifier is used to delimit the dial command for the voice call from the dial command for the data call. The T dial modifier, used with the dial command for the data call will be deleted and the character string *Texas* will be sent to the PBX. **NOTE:** If the T dial modifier is omitted, a data call will be dialed. However, the “T” in “Texas” will be deleted and only “exas” will be sent to the PBX resulting in a wrong number being dialed.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Comments — *Continued:*	The maximum length of the ASCII string is 39 characters; the AT prefix, the carriage return, and spaces used for readability do not add to the character count for the line.
See Also:	The &Z command on page A-31, Appendix B for information about Dial Modifiers, S-Register S8 on page C-15, and S-Register S14 on page C-20.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	E
Function:	Turn the command echo on or off.
Type:	configuration
Arguments:	No argument or an argument of 0 disables echo and an argument of 1 enables echo. The factory-default is 1.
S-Register:	Bit 1 of S14 is set according to the argument of the command.
Example:	ATE1 (ENTER)
Comments:	Typically, for a display terminal operating in full-duplex mode, use the 1 argument if you wish to see the AT commands on the screen as you type them. If your display terminal is operating in half-duplex mode, use the 0 argument (the 1 argument would cause characters typed to appear on the screen like `tthhiiss`).
See Also:	S-Register S14 on page C-20.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	H
Function:	Switch hook control.
Type:	immediate
Arguments:	No argument or an argument of 0 causes the 8400B Plus Data Module to go on-hook.
S-Register:	none
Example:	ATH (ENTER)
Comments:	The H command with no argument can be used during a data call to cause the 8400B Plus Data Module to go on-hook (hang up) after using the escape sequence (+++) to return to command mode. An argument of 0 produces the same result, and an argument of 1 is accepted but causes no action.
See Also:	

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	`I`
Function:	Request product code or ROM checksum.
Type:	immediate
Arguments:	The `I` command accepts one of three arguments as follows: 0 — The 8400B Plus Data Module displays the decimal number 249, followed by a carriage return and line feed. 1 — The 8400B Plus Data Module displays the ROM checksum as two four-digit hexadecimal values, followed by a carriage return and line feed. 2 — The 8400B Plus Data Module displays ***OK*** followed by a carriage return and line feed.
S-Register:	none
Example:	`ATI0` (ENTER)
Comments:	In the example, the 8400B Plus Data Module will return its product ID code as the value *249*.
See Also:	none

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	0
Function:	Return to the on-line mode.
Type:	immediate
Arguments:	No argument or an argument of 0 (zero) causes the 8400B Plus Data Module to return from command mode to on-line mode, if a data call is still active.
S-Register:	none
Example:	AT0 ENTER
Comments:	The 8400B Plus Data Module accepts an argument of 1 but treats it the same as no argument or an argument of 0.
See Also:	"From Data Mode to Command Mode and Back" on page 3-10 and the +++ command on page A-3.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	Q
Function:	Turn the display of result codes on or off.
Type:	configuration
Arguments:	No argument or an argument of 0 enables the display of result codes; an argument of 1 disables the display of result codes. The factory-default is result codes enable.
S-Register:	Bit 2 of S14 is set according to the argument used with the Q command.
Example:	ATQ1 ENTER
Comments:	In the example, the result codes are disabled. Use this option only if you wish to prevent the 8400B Plus Data Module from returning result codes after an AT command is issued.
See Also:	The V command on page A-18, the X command on page A-19, S-register S14 on page C-20, and the result codes on page E-7.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	S
Function:	Read from, or write to, an S-register.
Type:	immediate
Arguments:	The S command accepts one of three arguments as follows: *mm* — This argument, following the S command, establishes S-register *mm* as the last S-register accessed. *mm=nnn* — This argument, following the S command, sets S-register *mm* to the value specified by the number *nnn*. The *mm* may be omitted, in which case the last S-register accessed will be assumed. If the *mm* is omitted, then the S may also be omitted. *mm*? — This argument, following the S command, returns the decimal value of S-register *mm*. The *mm* may be omitted, in which case the last S-register accessed will be assumed. If the *mm* is omitted, then the S may also be omitted.
S-Register:	all

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Example:	ATS6 ENTER — establishes S-register S6 as the last accessed S-register. ATS6=4 ENTER — sets S-register S6 to the value of 4. ATS=4 ENTER — sets the value of the last S-register accessed to 4. AT=4 ENTER — sets the value of the last S-register accessed to 4. ATS6? ENTER — returns the current value of S-register S6. ATS? ENTER — returns the current value of the last S-register accessed. AT? ENTER — returns the current value of the last S-register accessed. AT=4? ENTER — sets the value of the last S-register accessed to 4, and returns the S-register's new value.
Comments:	If the value *nnn* is outside the acceptable range for that S-register, the value will be stored, but functionally the lower and higher range limits will be observed. Changes to the value of S-register S24 affect the active profile, as well as configuration profiles 0 and 1.
See Also:	''Installation Options'' on page 2-12 and Appendix C for information about S-registers.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	V
Function:	Select format for result codes.
Type:	configuration
Arguments:	No argument or an argument of 0 causes the 8400B Plus Data Module to return the short form or numeric result codes; an argument of 1 causes the 8400B Plus Data Module to return the verbose form or text message result codes. The factory-default setting is the verbose form.
S-Register:	Bit 3 of S14 is set according to the argument used with the V command.
Example:	ATV ENTER
Comments:	The example would set the short form or numeric result code format.
See Also:	The Q command on page A-15, the X command on page A-19, S-register S14 on page C-20, and the result codes on page E-7.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	X
Function:	Control the extended result codes.
Type:	configuration
Arguments:	The command accepts one of five arguments as follows: 0 — the basic result code set (0-4) is enabled. No busy code sent when line is busy. No speed indication with connect code. 1 — result codes 0-5, 10-12, and 14 are enabled. No busy code sent when line is busy. Speed indication with connect code. 2— result codes 0-5, 10-12, and 14 are enabled. No busy code sent when line is busy. Speed indication with connect code. 3— result codes 0-5, 7, 10-12, and 14 are enabled. Busy code sent when line is busy. Speed indication with connect code. 4— result codes 0-5, 7, 10-12, and 14 are enabled. Busy code sent when line is busy. Speed indication with connect code.
S-Register:	Bits 4, 5, and 6 of S22 are set according to the argument given with the command.
Example:	ATX2 (ENTER)

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Comments:	In the example, the results described under argument value 2 are implemented. Regardless of which argument is used, the 8400B Plus Data Module will wait until the call is completed, or the time set in S-register S7 expires. All arguments do change the appropriate bits in S-register S22 and affect the result codes returned.
See Also:	The Q command on page A-15, the V command on page A-18, S-register S22 on page C-27, and the result codes on page E-7.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	Z
Function:	Reset the 8400B Plus Data Module and recall a stored profile.
Type:	immediate
Arguments:	No argument or an argument of 0 recalls the configuration profile stored in location 0; an argument of 1 recalls the configuration profile stored in location 1.
S-Register:	none
Example:	ATZ1 (ENTER)
Comments:	In the example, the Z command causes the 8400B Plus Data Module to reset, and then loads the configuration profile stored in location 1 into the active location.
See Also:	"Configuration Parameters" on page 3-7.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	&C
Function:	Data Carrier Detect (DCD) options.
Type:	configuration
Arguments:	The &C command accepts one of two arguments as follows: 0 — (or no argument) maintain the DCD circuit *on* at all times (factory-default setting). 1 — the DCD circuit operates according to the EIA/TIA-574 standard.
S-Register:	Bit 5 of S21 is set according to the argument used with the &C command.
Example:	AT&C1 ENTER
Comments:	In the example, the DCD circuit operates according to the EIA/TIA-574 standard. This would be an appropriate setting for when the 8400B Plus Data Module is used at a remote site. Regardless of which option is currently in effect, the DCD circuit of the 8400B Plus Data Module is always off during self-test.
See Also:	S-register S21 on page C-25.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	&D
Function:	Data Terminal Ready (DTR) options.
Type:	configuration
Arguments:	The &D command accepts one of four arguments as follows: 0 — ignore the DTR interchange circuit (factory-default setting). 1 — return to the command state if an on-to-off transition is detected on the DTR input; an active data call is *not* disconnected. 2 — go on hook when an on-to-off transition is detected on the DTR input (EIA/TIA-574 standard); an active data call *is* disconnected. 3 — perform a reset if an on-to-off transition is detected on the DTR input; an active data call is disconnected.
S-Register:	Bits 3 and 4 of S21 are set according to the option used with the &D command.
Example:	AT&D2 ENTER
Comments:	In the example, the DTR circuit is set according to the EIA/TIA-574 standard. This would be an appropriate setting for when the 8400B Plus Data Module is used at a remote site as a dedicated device to automatically answer an incoming data call. If the change of state for the DTR circuit persists for a time shorter than specified in S25, the change is ignored.
See Also:	S-register S21 on page C-25.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	&F
Function:	Load the factory-default configuration.
Type:	immediate
Arguments:	none
S-Register:	none
Example:	AT&F ENTER
Comments:	The factory-default configuration values are permanently stored in ROM and can be recalled at any time. No reset or self-test is initiated by issuing the &F command. The &F command does not recall the factory-default installation options established by the value of S-register S24.
See Also:	“Configuration Parameters” on page 3-7.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	&S
Function:	Data Set Ready (DSR) options
Type:	configuration
Arguments:	The &S command accepts one of two arguments as follows: 0 — (or no argument) the DSR circuit is maintained on at all times (factory-default setting) 1 — the DSR circuit operates according to the EIA/TIA-574 standard.
S-Register:	Bit 6 of S21 is set according to the argument used with the &S command.
Example:	AT&S1 ENTER
Comments:	In the example, the DSR circuit is configured to operate according to the EIA/TIA-574 standard. Regardless of which option is currently in effect, the DSR circuit of the 8400B Plus Data Module is always off during self-test.
See Also:	S-register S21 on page C-25.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	&T
Function:	Control diagnostic and test facilities.
Type:	immediate
Arguments:	The &T command accepts one of eight arguments (see comment 2) as follows: 0 — (or no option) terminate any test in progress (see comment 3). 1 — initiate local loopback test. 2 — same as 1. 3 — initiate local data loopback test. 4 — allow remote loopback requests from the remote system (factory-default selection). 5 — deny remote loopback requests from the remote system. 6 — initiate remote loopback test. 7 — initiate remote loopback test with self-test. 8 — initiate local loopback test with self-test.
S-Register:	Bits 0 and 2—6 of S16 are set according to the argument used with the &T command.
Example:	AT&T3 ENTER (see comment 1)

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Comments:	1. In the example, a local data loopback test is initiated. 2. All argument values in the range of 0-8 are valid. All of the options selected by the command arguments described above are accepted and implemented by the 8400B Plus Data Module. 3. If the local digital loopback or remote digital loopback tests are in progress, it is necessary to issue the escape sequence to return to command mode before the `&T0` command can be used to terminate these tests. The test timer value stored in S-register `S18` can also be set to halt automatically any locally initiated test in progress.
See Also:	S-register `S16` on page C-22, S-register `S18` on page C-24, and Appendix D for information about performing loopback tests.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	&V
Function:	View the active configuration and stored profiles.
Type:	immediate
Arguments:	The &V command does not take an argument.
S-Register:	none
Example:	AT&V ENTER
Comments:	The &V command displays all active and stored configuration data as follows (see sample screen below): ■ command and S-register settings for the active configuration ■ command and S-register settings saved in configuration profiles 0 and 1 ■ contents of the four telephone number storage locations
See Also:	"Configuration Parameters" on page 3-7 and Figure C-1 on page C-2.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	&W
Function:	Store the active configuration profile.
Type:	immediate
Arguments:	No argument or an argument of 0 stores to location 0, an argument of 1 stores to location 1.
S-Register:	none
Example:	AT&W0 ENTER
Comments:	In the example, the currently active configuration profile is stored to memory location 0. Only a subset of the configuration parameters are actually stored.
See Also:	"Configuration Parameters" on page 3-7 and the &V command on page A-28.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	&Y
Function:	Designate the default configuration profile.
Type:	configuration
Arguments:	An argument of 0 will recall stored profile 0; an argument of 1 will recall stored profile 1. Factory-default selection is stored profile 0.
S-Register:	none
Example:	AT&Y1 ENTER
Comments:	In the example, the configuration profile stored in location 1 will be recalled the next time that the 8400B Plus Data Module is powered on. When the &Y command is issued, the currently active profile does *not* change until the 8400B Plus Data Module is powered off and then on again.
See Also:	"Configuration Parameters" on page 3-7 and the &V command on page A-28.

Table A-1. Accepted AT Command Labels — *Continued*

Label	Description
Command:	&Z
Function:	Store a telephone number.
Type:	immediate
Arguments:	The &Z command accepts one of four arguments (0 through 3), which designates the memory location in which the dialing string that follows the command will be stored.
S-Register:	none
Example:	AT&Z2=555-1212 ENTER
Comments:	In the example, the dial string 555-1212 is stored in memory location 2. Each of the four number storage locations can store a maximum of 25 characters.
See Also:	"Storing a Telephone Number" on page 3-11, the D command on page A-6, and Dial Modifier S=n on page B-4.

Dial Modifiers

B

Dial modifiers are only recognized when they appear in a dial string. A dial string is a string of characters following the D (dial command) unless otherwise noted. This appendix contains an explanation of each dial modifier accepted by the 8400B Plus Data Module. Labels used in the descriptions are defined as follows:

Table B-1. Dial Modifiers

Label	Description
Dial Modifier:	The dial modifier is shown as it should be typed. The dial modifier may be typed in uppercase or lowercase. Spaces may be typed between commands and dial modifiers on the same command line for readability, but the spaces are ignored by the 8400B Plus Data Module.
Function:	A brief, functional description of the dial modifier is provided here.
S-Register:	The S-registers consist of 28 1-byte memory locations in the data module, designated as S0 through S27. The S-registers hold values for defining the current configuration of the data module. Some commands modify a specific S-register, and some commands perform an action based on the current value stored in an S-register. Whether an S-register is modified or read by the current command is explained here.

Table B-1. Dial Modifiers — *Continued*

Label	Description
Example:	A sample command line follows this label to demonstrate how the command may be used.
Comments:	An explanation of the example and any other information about the command not provided elsewhere is provided here. Additional commands may be typed on the same command line with the command currently under discussion, unless noted otherwise.
See Also:	Following this label are suggestions on where to look for more information about the current command and a listing of any other commands that may be used with or affect the use of the current command.

Table B-1. Dial Modifiers — *Continued*

Label	Description
Dial Modifier:	P
Function:	Request to make a voice call.
S-Register:	S6
Example:	`ATDP9, 9570000`
Comments:	The purpose of the P dial modifier is to signal the 8400B Plus Data Module to dial the number that follows as a voice call. When entered immediately after the D in a dial command and/or as the first character in a stored number, the 8400B Plus Data Module will place a voice call. When the P is omitted or the T is used, the 8400B Plus Data Module will place a data call. When the P is entered after the D and a stored number is dialed, a voice call is made even if the first character of a stored number is the T dial modifier. The blind dial S-register (S6) is used to delay between going off-hook and dialing the first digit.
See Also:	"Voice Operations" on page 3-18 and S-register S6 on page C-13.

Table B-1. Dial Modifiers — *Continued*

Label	Description
Dial Modifier:	S=*n*
Function:	Dial the number stored in location *n*, where *n* has a value 0-3.
S-Register:	none
Example:	ATDS=0 ENTER
Comments:	The S=*n* dial modifier allows the 8400B Plus Data Module to dial a number previously stored with the &Zn command. In the above example, the number stored in location 0 is dialed. The S=*n* dial modifier can also be used for voice calls.
See Also:	"Voice Operations" on page 3-18 and the &Z command on page A-31.

Table B-1. Dial Modifiers — *Continued*

Label	Description
Dial Modifier:	T
Function:	Request to make a data call.
S-Register:	none
Example:	`ATDT918006230718` (ENTER)
Comments:	The purpose of the `T` dial modifier is to signal the 8400B Plus Data Module to dial the number that follows as a data call. When entered immediately after the `D` in a dial command and/or as the first character in a stored number, the 8400B Plus Data Module will place a data call. When the `T` is omitted, the 8400B Plus Data Module will still place a data call.
See Also:	"Data Operation" on page 3-10.

Table B-1. Dial Modifiers — *Continued*

Label	Description
Dial Modifier:	, (comma)
Function:	Used as the pause character for voice calls.
S-Register:	S8
Example:	`ATD P 9,1,8005551212`
Comments:	The comma causes the 8400B Plus Data Module to delay dialing. On voice calls, the pause time is stored in the S-register S8. Dialing is not delayed when the stored value is zero. On data calls, the comma (,) is passed to the PBX, which will delay dialing by the parameter set in administration.
See Also:	"Dialing Pause" on page 3-19 and S-register S8 on page C-15.

Table B-1. Dial Modifiers — *Continued*

Label	Description
Dial Modifier:	; (semicolon)
Function:	Terminates the dial string, and returns to command state after processing a dial command.
S-Register:	none
Example:	`AT DT 9,1 800 624-5123; DP 555-1212; O`
Comments:	The semicolon returns you to a command state and allows you to enter more commands. In the above example, a data call is made, and the semicolon returns you to the command mode. A voice call is then made and the 0 sends you back to the data connection. When the dial command specifies a stored number to be dialed, the semicolon can be entered after the S=*n* command. If a semicolon is omitted, the call is made, but all commands following the dial command will be ignored if the call was a data call. If the dial command for a voice call is the last command on the command line, the semicolon dial modifier may be omitted (the 8400B Plus Data Module will still return to the command mode).
See Also:	none

S-Registers

C

This appendix contains an explanation of each S-register used by the 8400B Plus Data Module. There are a total of 28 S-registers. Twenty-two S-registers are used to store configuration parameters, one is used to store installation options, and the remaining five are unused. Eleven registers can be stored in nonvolatile memory, which will be restored when the unit is powered up. There are two sets of stored registers, or profiles. When the 8400B Plus Data Module is first powered on, the values that were last stored in the S-registers are the values in effect until AT commands are issued to change them.

You can check the current value stored in all S-registers with the &V command (see the description on page A-28). The &V command displays all active and stored configuration data as shown in Figure C-1 on page C-2.

```
ACTIVE PROFILE:
B1 E1 L2 M1 Q0 V1 X4 Y0 &C0 &D0 &G0 &J0 &L0 &P0 & Q0 &R0 &S0 &X0 &Y0
S00:000 S01:000 S02:043 S03:013 S04:010 S05:008 S06:002 S07:060
S08:002 S09:006 S10:014 S12:050 S14:AAH S16:00H S18:000 S21:00H
S22:76H S23:0BH S24:00H S25:005 S26:001 S27:40H

STORED PROFILE 0:
B1 E1 L2 M1 Q0 V1 X1 Y0 &C0 &D0 &G0 &J0 &L0 &P0 &Q0 &R0 &S0 &X0
S00:000 S14:AAH S18:000 S21:00H S22:46H S23:0BH S24:00H S25:005
S26:001 S27:40H

STORED PROFILE 1:
B1 E1 L2 M1 Q0 V1 X4 Y0 &C0 &D0 &G0 &J0 &L0 &P0 &Q0 &R0 &S0 &X0
S00:000 S14:AAH S18:000 S21:00H S22:46H S23:0BH S24:00H S25:005
S26:001 S27:40H

TELEPHONE NUMBERS:
&Z0= 34017
&Z1= 95551212
&Z2= 74802
&Z3= PARIS

OK
```

Figure C-1. Active and Stored Configuration Data

To look at the contents on just one register, use the command S*mm*? where *mm* is the number of the S-register. The data module will return three digits, representing the decimal value of the specified S-register.

To change the value in any one S-register directly, use the command S*mm=nnn* where *mm* is the number of the S-register and *nnn* is the number you wish to place in the register. The following dialog illustrates the use of the S command to read and change the value contained in an S-register:

ATS18? ENTER
055

OK
ATS18=120 ENTER
OK

The first command requests the value stored in register S18. The 8400B Plus Data Module returns a 3-digit decimal value of ***055***, followed by ***OK***. The next command changes the value in register S18 to ***120***, and the data module responds with ***OK***. You could enter the first command a second time to verify that the value was changed correctly.

More information is provided in the following definitions of the labels used in the S-register descriptions.

Table C-1. Labels Used in S-Registers

Label	Description
Register:	The S-register is identified following this label. Note that the names for S-registers 1 through 9 may be typed as two-digit numbers with leading zeros, if desired, for readability (for example, S01 is equivalent to S1).
Description:	The purpose and use for the S-register is explained following this label.
Range of Values:	The range of values that may be assigned to the register is explained following this label. The units for the value may be as follows: ■ *decimal* — a one- to three-digit decimal number. Decimal numbers are typically used to represent a count, seconds, or fractions of a second. ■ *ASCII* — a one- to three-digit decimal number that represents the decimal equivalent for an ASCII character (see the ASCII Character Set; Table E-7 on page E-11). ■ *hexadecimal* — a two-digit hexadecimal number used to represent the contents of a bit-mapped S-register. Bit-mapped S-registers are not usually set by entering a complete value for the register, but are set one or more bits at a time by various AT commands. Hexadecimal digits include the decimal digits 0 through 9 and the letters A through F.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
	NOTE: A value typed as a decimal or ASCII argument to a command may be entered as a one-, two-, or three-digit number, as required, but will always be displayed as a three-digit number (for example, you type the command ATS0=3 to set automatic answer feature to answer an incoming call on the third ring, and then type the AT&V command to verify the value, which is displayed as ***S00:003***). The &V command, which displays the contents of all S-registers, presents the contents of bit-mapped registers as two hexadecimal digits followed by an uppercase letter H (for example, assuming that S-register S14 contains the value AA hexadecimal, the AT&V command displays ***S14:AAH***).
Storable:	A *yes* after this label indicates that the contents of this S-register will be written when the current configuration profile is saved to one of the two configuration profile storage locations. A *no* here indicates that the contents of the S-register will *not* be written to storage. **NOTE:** Any changes to nonstorable S-registers are lost when power is removed from the Data Module; however, the &Y command can be set to load a specific stored configuration profile at start up, and the values set by AT command arguments in the recalled profile will be placed into effect.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Comments:	Additional information about the S-register is presented following this label.
See Also:	Following this label are references to other parts of this manual where you will find more information, and/or a list of other S-registers or AT commands that are associated with this S-register.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S0
Description:	The value in this S-register represents the ring number on which an incoming call will be automatically answered.
Range of Values:	The value may be 000 through 255 rings. The factory-default setting is 000 rings.
Storable:	yes
Comments:	Setting S-register S0 to any value from 001 through 255 enables automatic answer; a value of 000 disables automatic answering. The count of incoming rings is stored in S-register S1.
See Also:	"Automatic Answering" on page 3-13 and S-register S1 on page C-8.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S1
Description:	The number of incoming rings detected. Incremented each time a ring is detected. It is cleared if no rings are detected for eight seconds.
Range of Values:	The value may be 000 through 255 rings. The factory-default setting is 000 rings.
Storable:	no
Comments:	In the 8400B Plus Data Module, incoming rings are not detected as such. The PBX notifies the 8400B Plus Data Module of an incoming call and a ring cycle (RI lead) is generated internally. The register is incremented after each ring cycle.
See Also:	S-register S0 on page C-7.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S2
Description:	This S-register stores the ASCII value of the escape sequence character.
Range of Values:	Value may be 000 through 127 (see comments); factory-default setting is 043, the ASCII code for a plus sign (+).
Storable:	no
Comments:	Setting the value greater than 127 will disable escape sequence detection, in which case the escape sequence cannot be used to move to command mode. The operation of the Data Terminal Ready (DTR) circuit, set by the &D command, can still be used to move to command mode without disconnecting the call.
See Also:	"From Data Mode to Command Mode and Back" on page 3-10 and the &D command on page A-23.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S3
Description:	This S-register stores the ASCII value of the carriage return character.
Range of Values:	Value may be 000 through 127; factory-default setting is 013, usually by the ENTER or RETURN key or the CTRL M key combination from a data terminal.
Storable:	no
Comments:	This character serves as the command terminator on an AT command line. It is also output following all result codes.
See Also:	"Command Line Set Up" on page 3-3.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S4
Description:	This S-register stores the ASCII value for the line feed character.
Range of Values:	Value may be 000 through 127; factory default setting is 010, usually output by the CTRL J key combination from a display terminal.
Storable:	no
Comments:	none
See Also:	none

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S5
Description:	This S-register stores the ASCII value for the backspace character.
Range of Values:	Value may be 000 through 032 and 127; factory-default value is 008, usually output by the BACKSPACE key of the data terminal.
Storable:	no
Comments:	The operation of the backspace character is to move the cursor left one character space and (on a command line) erase the character moved to. If command echo is enabled (AT command E1), the output of the backspace character is actually three characters: backspace, space, backspace.
See Also:	"Command Line Set Up" on page 3-3.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S6
Description:	This S-register controls the blind dial delay interval for voice dial calls.
Range of Values:	Value may be 000 through 255 seconds; factory-default is 2 seconds.
Storable:	no
Comments:	The 8400B Plus Data Module uses the blind dialing method to originate voice calls since it does not contain a dial-tone detector. When an off-hook message is sent to the PBX, the 8400B Plus Data Module pauses for the specified time before dialing the call.
See Also:	"Dialing Delay" on page 3-19.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S7
Description:	Wait time for connection to remove endpoint. If the data mode is not entered within this time, the call will be disconnected.
Range of Values:	Value may be 001 through 255 seconds; factory-default value is 060 seconds.
Storable:	yes
Comments:	Even though S7 is storable, it is not displayed with the stored profile data generated by the AT&V command.
See Also:	"Dialing a Data Call" on page 3-10.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S8
Description:	This S-register controls the duration of delay for pauses for voice calls.
Range of Values:	Value may be 000 through 255 seconds; factory-default value is 2 seconds.
Storable:	no
Comments:	The 8400B Plus Data Module supports the comma dial modifier to provide pauses in the dialing process for a voice call. (The comma is sent to the switch for data calls.)
See Also:	The comma (,) dial modifier on page B-6 and "Dialing Pause" on page 3-19.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S9
Description:	This S-register establishes the length of time a receive carrier signal must be present to be recognized and cause the Data Carrier Detect (DCD) circuit to turn on. This prevents a ring or busy signal from being mistaken as a carrier.
Range of Values:	Value may be 000 through 255 tenths of a second; factory-default value is six tenths of a second.
Storable:	no
Comments:	This feature is unnecessary in the DCP operating environment of the 8400B Plus Data Module. The value in S9 may be set or read but is always ignored.
See Also:	none

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S10
Description:	The value in this S-register determines how long the 8400B Plus Data Module will wait after loss of line signal is detected before disconnecting.
Range of Values:	Value may be 000 through 255 tenths of a second; factory-default is 14 tenths of a second (1.4 seconds).
Storable:	no
Comments:	The delay set by this S-register allows the receive line signal to disappear momentarily without causing a disconnect (hang up). Setting this S-register to the maximum value (255) causes the Data Module to ignore receive line signal status and not disconnect the data call if line signal is lost.
See Also:	none

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S11
Description:	This S-register determines the duration and spacing of tones in Dual-Tone Multifrequency (DTMF) dialing.
Range of Values:	Value may be 000 through 255 milliseconds; factory-default value is 95 milliseconds.
Storable:	no
Comments:	This feature is unnecessary in the DCP operating environment of the 8400B Plus Data Module. The value in S11 may be set or read but is always ignored.
See Also:	none

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S12
Description:	The value in this S-register determines the minimum delay required immediately before and after entering the escape sequence (guard time). It also determines the maximum interval allowed between entering each of the three consecutive characters of the sequence.
Range of Values:	Value may be 000 through 255 fiftieths (0.02) of a second; factory-default value is 50 fiftieths of a second (1 second).
Storable:	no
Comments:	If the value in this S-register is set to 0, timing is not a factor in escape sequence recognition.
See Also:	"From Data Mode to Command Mode and Back" on page 3-10 and the +++ command on page A-3.
Register:	S13 — not used.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S14
Description:	This S-register is used to store the status of bit-mapped options as follows: bit 0 — not used (always set to 0) bit 1 — 0 = command echo disabled, 1 = command echo enabled (default = 1, see E command) bit 2 — 0 = result codes enabled, 1 = result codes disabled (default = 0, see Q command) bit 3 — 0 = short result codes, 1 = verbose result codes (default = 1, see V command) bit 4 — not used (always set to 0) bit 5 — 0 = tone, 1 = dial pulse (default = 1, see comment 1) bit 6 — not used (always set to 0) bit 7 — 0 = answer mode, 1 = originate mode (default = 1, see A and D commands)
Range of Values:	Value may be 00 through FF hexadecimal; factory-default settings produce a value of AA (see comment 2).
Storable:	yes
Comments:	1. In the DCP operating environment of the 8400B Plus Data Module, tone and pulse dialing have no meaning. For the 8400B Plus Data Module, T is used to specify a data call and P is used to specify a voice call. 2. Refer to the explanation of hexadecimal values under the “Range of Values” heading on page C-4.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
See Also:	"Command Acknowledgment" on page 3-4, the A command on page A-4, the D command on page A-6, the Q command on page A-15, and the V command on page A-18.
Register:	S15 — not used.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S16
Description:	This S-register stores test function status in a bit-mapped format as follows: bit 0 — local digital loop test; 0 = test disabled, 1 = test in progress (default = 0, see the &T1 and &T2 commands) bit 1 — not used (always set to 0) bit 2 — local data loop test; 0 = disabled, 1 = test in progress (default = 0, see &T3 command) bit 3 — status bit for remote digital loop initiated by remote system; 0 = off, 1 = in progress (default = 0, see &T4 and &T5 commands) bit 4 — remote digital loop; 0 = disabled, 1 = in progress (default = 0, see &T6 command) bit 5 — remote digital loop with self-test; 0 = disabled, 1 = in progress (default = 0, see &T7 command) bit 6 — local digital loop with self-test; 0 = disabled, 1 = in progress (default = 0, see &T8 command) bit 7 — not used (always set to 0).
Range of Values:	Value may be 00 through FF hexadecimal; factory-default settings produce a value of AA (see comment 1).
Storable:	no

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Comments:	1. Only one of the tests may be in progress at any time. The T0 command terminates any locally initiated test in progress and sets S-register S16 to 00. 2. Refer to the explanation of hexadecimal values under the “Range of Values” heading on page C-4.
See Also:	The &T command on page A-26 and Appendix D for information about performing loopback tests.
Register:	S17 — not used.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S18
Description:	The value in this S-register establishes the duration of diagnostic tests initiated by the &T command.
Range of Values:	Value may be 000 through 255 seconds. The factory-default value is 0.
Storable:	yes
Comments:	Any locally initialized test in progress is automatically terminated when the time specified in S-register S18 has elapsed. If S-register S18 is set to 0, a test initiated by the &T command must be terminated manually. Issuing the &T0 command terminates any locally initiated test immediately, regardless of the value in S-register S18.
See Also:	The &T command on page A-26, and Appendix D for information about performing loopback tests.
Register:	S19 — not used.
Register:	S20 — not used.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S21
Description:	This S-register is used to store the status of bit-mapped options as follows: bit 0 — telephone jack options; set by &J command (default = 0, see comment 1) bit 1 — not used (always set to 0) bit 2 — RTS/CTS options; set by &R command (default = 0, see comment 1) bits 3 and 4 — DTR options; value depends on argument of DTR option command (default = 00, see &D command) bit 5 — DCD options; 0 = always on, 1 = EIA/TIA-574 standard (default = 0, see &C command) bit 6 — DSR options; 0 = always on, 1 = EIA/TIA-574 standard (default = 0, see &S command) bit 7 — long space disconnect options; (default = 0, set by Y command, see comment 1)
Range of Values:	Value may be 00 through FF hexadecimal; factory-default settings produce a value of 00 (see comment 2).
Storable:	yes
Comments:	1. For the 8400B Plus Data Module, bits 0, 2, and 7 will be set by the appropriate command; however, there will be no other effect. 2. Refer to the explanation of hexadecimal values under the “Range of Values” heading on page C-4.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
See Also:	The &C command on page A-22, the &D command on page A-23, and the &S command on page A-25.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S22
Description:	This S-register is used to store the status of bit-mapped options as follows: bits 0 and 1 — speaker volume; (default = 2, set by L command, see comment 1) bits 2 and 3 — speaker control; (default = 1, set by M command, see comment 1) bits 4, 5, and 6 — result codes; value depends on argument of result code options command (default = 0, see X command) bit 7 — make/break ratio; (default = 0, set by &P command, see comment 1)
Range of Values:	Value may be 00 through FF hexadecimal; factory-default settings produce a value of 76 (see comment 2).
Storable:	yes
Comments:	1. For the 8400B Plus Data Module, bits 0 through 3 and bit 7 will be set by the appropriate command; however, there will be no other effect. 2. Refer to the explanation of hexadecimal values under the “Range of Values” heading on page C-4.
See Also:	"Command Acknowledgment" on page 3-4 and the X command on page A-19.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S23
Description:	This S-register is used to store the status of bit-mapped options as follows: bit 0 — allow remote loop request from remote system; 0 = disabled, 1 = enabled (default = 1, see &T command) bits 1, 2, and 3 — local communications speed (see comment 1) 0 = 300 bps 1 = not used 2 = 1200 bps 3 = 2400 bps (factory-set default) 4 = 4800 bps 5 = 9600 bps 6 = 19200 bps 7 = not used bits 4 and 5 — local parity setting; 0 = even, 1 = space, 2 = odd, and 3 = mark/none (default = 0) bits 6 and 7 — guard tones; (default = 0, set by &G command, see comment 2)
Range of Values:	Value may be 00 through FF hexadecimal; factory-default settings produce a value of 07 (see comment 3).
Storable:	yes

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Comments:	1. Hayes compatible modems use only bits, 0, 1, and 2 for speeds up to 2400 bps. The 8400B Plus Data Module uses bit 3 to support speeds above 2400 bps. 2. Bits 6 and 7 are set by the appropriate command, but there will be no other effect. 3. Refer to the explanation of hexadecimal values under the “Range of Values” heading on page C-4.
See Also:	"AT Command Line Prefix" on page 3-2, the &T command on page A-26, and Appendix D for information about performing remote loopback tests.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S24
Description:	This S-register is used to store the status of all installation options: bit 0 — 0 = with telephone, 1 = without telephone bit 1 — 0 = Mu-Law companding, 1 = A-Law companding bit 2 — 0 = external DTMF, 1 = internal DTMF bit 3 — (not used) bit 4 — 0 = data metering disabled, 1 = data metering enabled bit 5 — 0 = delay speakerphone disabled, 1 = delay speakerphone enabled bit 6 — 0 = speakerphone activation enabled, 1 = speakerphone activation disabled bit 7 — 0 = make busy on local disabled, 1 = make busy on local enabled
Range of Values:	Value may be 00 through FF hexadecimal; factory-default settings produce a value of 00.
Storable:	yes
Comments:	Value not affected by the &F command. The Sr=*n* command must be used to change the installation options.
See Also:	"Installation Options" on page 2-12 and the S command on page A-18.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S25
Description:	The value in this S-register determines how long a change of state (OFF to ON or ON to OFF) on the DTR lead must persist before it is acknowledged. If the change of state persists for a shorter time than is specified in S-register S25, it is ignored.
Range of Values:	Value may be 000 through 255 hundreds of a second (0.01 second). The factory-default value is 5 (0.05 second).
Storable:	yes
Comments:	none
See Also:	The &D command on page A-23.

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S26
Description:	When the &R0 option is selected, this S-register specifies the delay interval between an OFF to ON transition of RTS and turning ON CTS. This pertains to synchronous operation only.
Range of Values:	Value may be 000 through 255 hundredths of a second; factory-default value is 0.
Storable:	yes
Comments:	This feature is unnecessary in asynchronous-only operation. The value in S26 may be set or read, but is always ignored.
See Also:	none

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Register:	S27
Description:	This S-register is used to store the value of all bit-mapped options. bits 0, 1, 3 — transmission mode selection (set by &M and &Q commands, see comments): ■ 0 = asynchronous mode (default) ■ 1 = synchronous mode 1 ■ 2 = synchronous mode 2 ■ 3 = synchronous mode 3 ■ 4 = synchronous mode 4 bit 2 — switched/leased line operation (set by &L command, see comments): ■ 0 = switched line (default) ■ 1 = leased line bits 4, 5 — synchronous transmit clock (set by &X command, see comments): ■ 0 = &X0 option (default) ■ 1 = &X1 option ■ 2 = &X2 option ■ 3 is not used bit 6 — protocol for 1200 bps operation (set by B command, see comments): ■ 0 = CCITT V.22 ■ 1 = Bell 212A (default) bit 7 — (not used - always set to 0)

Table C-1. Labels Used in S-Registers — *Continued*

Label	Description
Range of Values:	Value may be 00 through FF hexadecimal; factory-default settings produce a value of 40 hexadecimal.
Storable:	yes
Comments:	In the 8400B Plus Data Module, bits 2, 4, 5, and 6 will be set by the appropriate commands. However, there will be no other effect. Bits 0, 1, and 3 will always be 0.
See Also:	none

Isolating Problems Using Loopback Data Tests

D

This appendix provides information on how to perform loopback tests to isolate problems involving the 8400B Plus Data Module.

Data Loopback Test

The data loopback test aids the remote user. It excludes the local EIA interface and the local data terminal equipment. The remote equipment sends a test message that is received at the local 8400B Plus Data Module. The test message is then looped back to the remote endpoint. This allows the remote user to verify that the remote endpoint and communication link are operating correctly.

NOTE:
A data call *must* be in progress for the data loopback test.

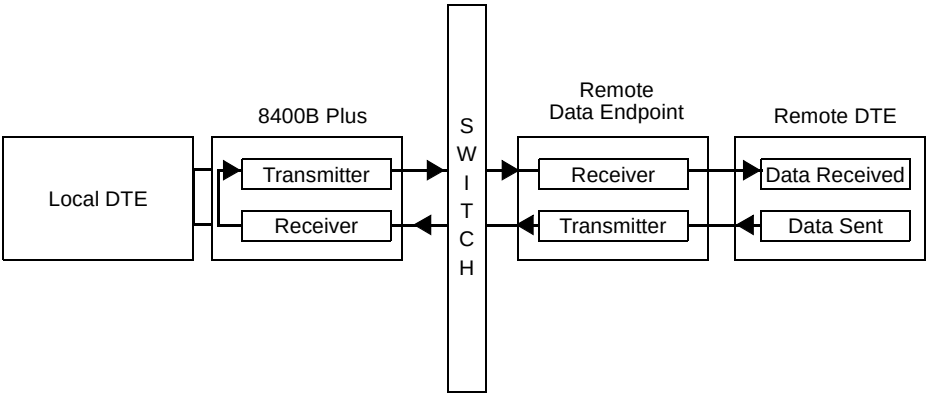

Figure D-1. Data Loopback Test

Performing a Data Loopback Test

To initiate the test, set up a data call and escape to command mode (+++). Then type:

AT&T3 ENTER

The system responds with:

OK

The remote endpoint user types characters (which will not appear on your screen) and will call you on another line to inform you of the test results. This test will continue for the period of time indicated in S-register S18.

If the remote endpoint user tells you to terminate the test before the period of time indicated in S-register S18, type:

AT&T0 ENTER

The system responds with the completion signal:

OK

Local Loopback Test

This test evaluates the connection between your terminal or PC and the 8400B Plus Data Module. With this test, you can send data from your keyboard, through the computer, to the data module. The data module then returns the data to your computer screen without sending it over any communications line. This allows you to compare the characters on the screen with those you typed. If the data does not match, troubleshoot your EIA Connector cord and terminal. If these are operating correctly, your 8400B Plus Data Module may be defective. Call the Lucent Technologies Technical Service Center at 1 800 242-2121.

NOTE:
Initiating this test disconnects a call if one is in progress.

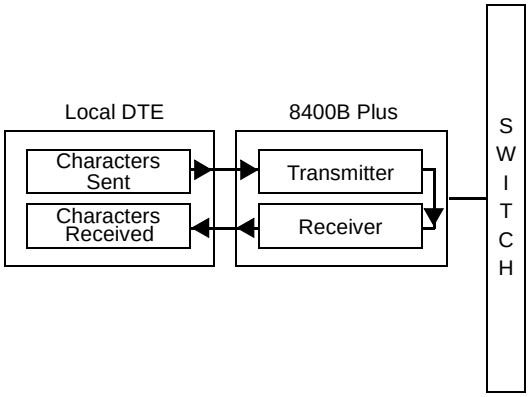

Figure D-2. Local Loopback Test

Performing a Local Loopback Test

To initiate the test, type:

AT&T1 ENTER

Type any string of characters. Compare the characters on the screen with those you typed. If the data does not match, troubleshoot your EIA Connector cord and terminal. If these are operating correctly, your data module may be defective. Call the Lucent Technologies Technical Service Center at 1 800 242-2121.

This test will continue for the period of time indicated in S-register S18. To terminate the test before the test timer expires, type:

+++

The system responds with:

OK

Type:

AT&T0 ENTER

The system responds with:

OK

Local Loopback Test with Self-Test

This test evaluates the data module's transmit and receive circuitry by having the data module generate test characters internally. At the end of the test, the 8400B Plus Data Module displays a three-digit number indicating the number of errors that occurred during the test. If you receive an error count other than zero, you may have a defective data module. Call the Lucent Technologies Technical Service Center at 1 800 242-2121.

NOTE:
Initiating this test disconnects a call if one is in progress.

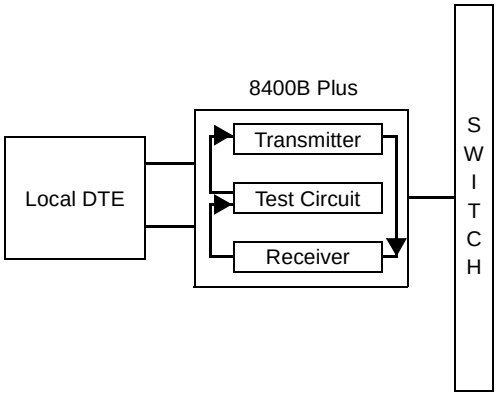

Figure D-3. Local Loopback Test with Self-Test

Performing a Local Loopback Test with Self-Test

To initiate the test, type:

AT&T8 ENTER

This test will continue for the period of time indicated in S-register S18. To terminate the test before the test timer expires, type:

AT&T0 ENTER

The system responds with the error count, then the completion signal:

000
OK

If an error count other than 000 is returned, repeat this test procedure. If the error count is still other than 000, this indicates a problem within the data module. Call the Lucent Technologies Technical Service Center at 1 800 242-2121.

Remote Loopback Test

This test evaluates the quality of the data transmission channel, and verifies the proper operation of the 8400B Plus Data Module, the local terminal, and the remote data module.

This test can only be performed with a remote data module capable of supporting a Remote Loopback Test. The remote DCE must be configured to loop the characters back to the 8400B Plus Data Module. If the remote endpoint is an 8400B Plus Data Module, its user must issue an AT&T4 command. This provisions the data module to accept a remote loopback request. If the remote data module does not respond to the Remote Loopback Test request, the test request will be aborted.

Using this test, you will generate your own test message. Once you establish a call and initiate the test, the following occurs:

- data is transmitted through the 8400B Plus to the remote DCE,
- the remote DCE is put into remote loopback mode, and then
- the data is looped back through the 8400B Plus to your data terminal equipment.

You can then compare the received message with the transmitted message.

Passing the test indicates that all elements of data transmission are operating properly, at least up to and through part of the remote endpoint. If data errors occur during normal data-transmission mode, the problem is further into the remote endpoint, or its attached data terminal equipment.

Failing this test does *not* necessarily indicate that the 8400B Plus Data Module is defective. Should this occur, perform both a Local Loopback Test and then a

Local Loopback Test with Self-Test to isolate the source of the problem between the data terminal equipment and the 8400B Plus Data Module's EIA interface or the communications channel.

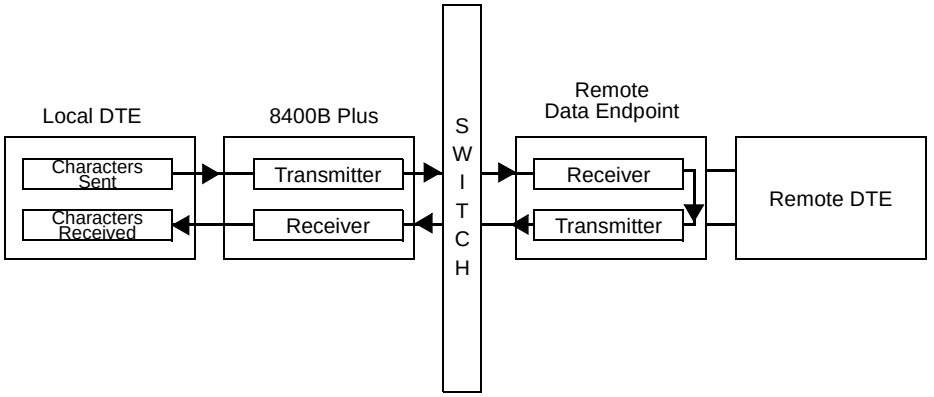

Figure D-4. Remote Loopback Test

Performing a Remote Loopback Test

To initiate the test, set up a data call and escape to command mode (+++). Then type:

AT&T6 ENTER

The system responds with:

OK

This test will continue for the period of time indicated in S-register S18.

To terminate the test before the test timer expires, type:

+++

The system responds with:

OK

To halt the test, type:

`AT&T0` (ENTER)

The system responds with the error count, then the completion signal:

OK

Remote Loopback Test with Self-Test

This test evaluates the quality of the data transmission channel, and the proper operation of the local and remote 8400B Plus Data Modules. During this test, the local data module generates test characters and transmits these to the remote endpoint, where they are looped back to the 8400B Plus Data Module. At the end of the test, the 8400B Plus Data Module displays a three-digit number indicating the number of errors that occurred during the test. Failing this test does not necessarily indicate a defective data module. It may instead indicate a problem in the communication channel or the remote endpoint. If you receive an error count other than zero, perform the Local Loopback Test with Self-Test to isolate the source of the problem — either the local 8400B Plus Data Module, the communications channel, or the remote endpoint.

The remote DCE must be configured to loop the characters back to the 8400B Plus Data Module. If the remote endpoint is an 8400B Plus Data Module, its user must issue an `AT&T4` command. This provisions the data module to accept a remote loopback request. If the remote data module does not respond to the Remote Loopback Test request, the test request will be aborted.

NOTE:
A data call *must* be in progress for this test.

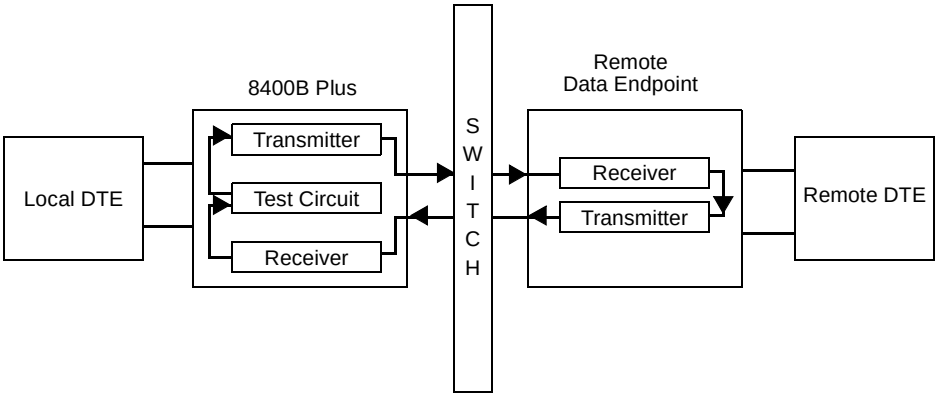

Figure D-5. Remote Loopback Test with Self-Test

Performing a Remote Loopback Test with Self-Test

To initiate the test, set up a data call and escape to command mode (+++). Then type:

AT&T7 ENTER

This test will continue for the period of time indicated in S-register S18. To terminate the test before the test timer expires, type:

AT&T0 ENTER

The system responds with the error count, then the completion signal:

000
OK

Loop-Around Data Test Arrangement

The 8400B Plus Data Module Loop-Around Data Test Arrangement provides a simple mechanism that can be installed on a DEFINITY Communications System, to isolate Digital Communications Protocol (DCP) data problems. In the Loop-Around Data Test Arrangement one or more 8400B Plus Data Modules are set up for auto-answer, and have the received data lead looped around to the transmit data lead on the data module's EIA interface. A user can then dial up, and see whether data typed in at the local station is echoed back. A typical use for this would be a user who calls the Help Desk with the complaint that he/she cannot access a local host. The user can be instructed to utilize the Loop-Around Data Test Arrangement (see Figure D-6).

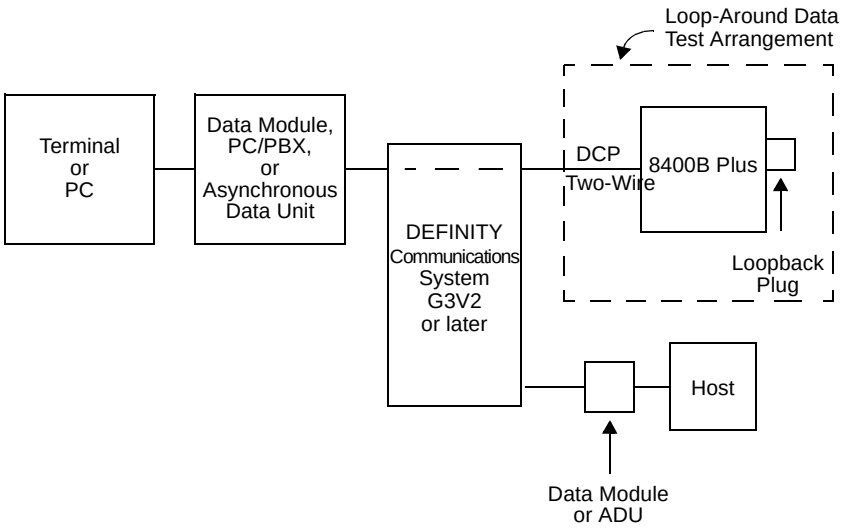

Figure D-6. Local Configuration, Using Loop-Around Data Test Arrangement

If the user is successful in connecting to the Test Arrangement (the data typed in is echoing back) then be assured that the user's desktop equipment and connection through the switch are functioning correctly. Help Desk personnel can than look elsewhere for the problem, saving valuable time in trouble isolation.

A Loop-Around Data Test Arrangement can also be useful for modem pool calls. An off-premises user having trouble connecting to a host can call to use the Loop-Around Data Test Arrangement (see Figure D-7). Again, if the call succeeds, the problem is not in the modem pool.

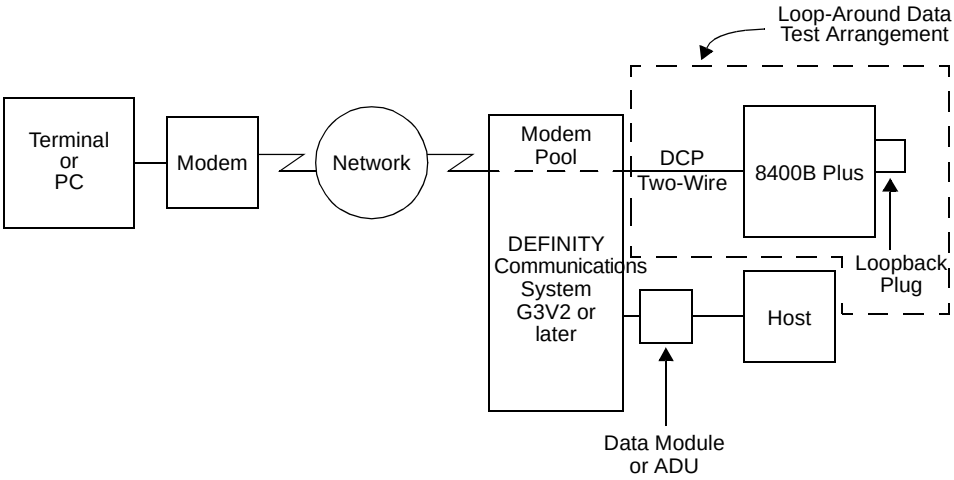

Figure D-7. Using the Loop-Around Data Test Arrangement with Modem Pooling

The Loop-Around Data Test Arrangement is also useful for isolating problems in networks of digitally connected switches. The scenario is a user at one site needing to access a host at another site and having problems. The user is instructed by the Help Desk to call the local Loop-Around Data Test

Arrangement. If this succeeds, the problem is isolated to the network or to the remote host equipment. The user is then instructed to call a Loop-Around Data Test Arrangement at the host site (see Figure D-8). If this call succeeds, then the problem is not in the network between the switches.

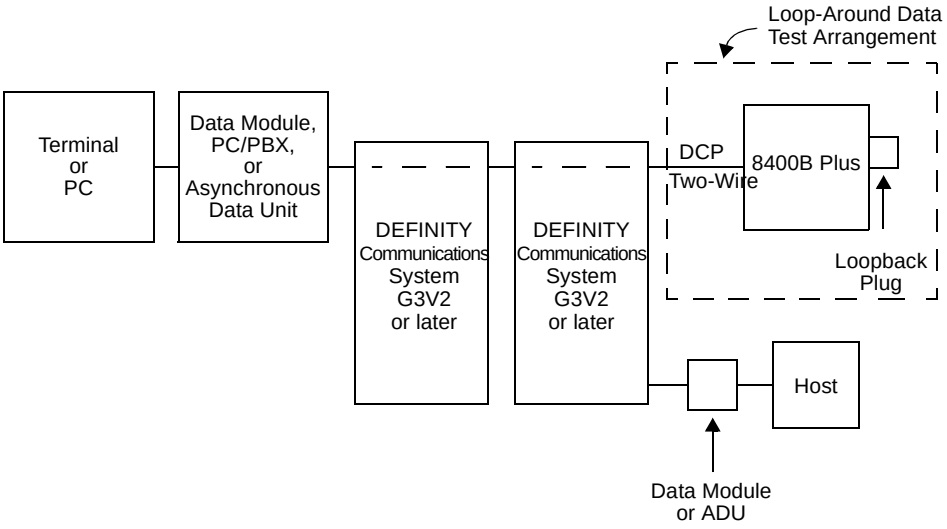

Figure D-8. Using the Loop-Around Data Test Arrangement in a Network

Setting Up a Loop-Around Data Test Arrangement

The Loop-Around Data Test Arrangement does not require special switch administration over and above the normal switch administration procedure for the 8400B Plus Data Module.

If the Loop-Around Data Test Arrangement is being used to test modem pools (see Figure D-7), separate 8400B Plus Data Modules must be set up for each

modem pool group to be tested. Separate telephone numbers should be administered for the Loop-Around Data Test Arrangements used for modem pool testing.

The 8400B Plus Data Module must be connected to the PBX and powered up prior to using it in the Loop-Around Data Test Arrangement. Connect an asynchronous data terminal to the 8400B Plus Data Module using the standard EIA Connector cord and supplied M9/F25 Adapter. The speed of the terminal should be set as indicated in Table D-1.

Table D-1. Setting Data Terminal Speed

Access	Set Terminal Data Rate To
Direct	19200 bps
Through a modem pool that supports speeds of:	
■ 300 and 1200 bps	1200 bps
■ 300, 1200, and 2400 bps	2400 bps
■ 1200, 2400, 4800, and 9600 bps	9600 bps
■ 4800 and 9600 bps	9600 bps

Once the data rate has been set on the terminal, type the following command:

`AT&FS0=1E0Q1&W0&W1` ENTER

Also set the correct installation options by typing the appropriate command:

- If the 8400B Plus Data Module is the US Configuration, type:

  `ATS24=1` ENTER

- If the 8400B Plus Data Module is the International Configuration, type:

  `ATS24=3` ENTER

You should now disconnect the terminal from the 8400B Plus Data Module. The 8400B Plus Data Module will retain the option settings during power removal.

A loopback plug must now be connected to the EIA Connector Interface of the 8400B Plus Data Module. A loopback plug connects pin number 2 to pin number 3 on the 8400B Plus Data Module's EIA Interface using a modified 9-pin connector. The modified connector is shown in Figure D-9.

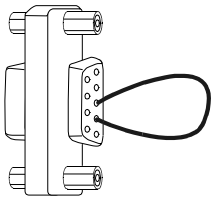

Figure D-9. 9-Pin Connector Wired as a Loopback Plug

Using the Loop-Around Data Test Arrangement

The user calls the Loop-Around Data Test Arrangement from a terminal/PC. Once connected, the user checks to see if characters entered from the keyboard are successfully echoed back. If the terminal/PC is set for full duplex and the user types in

```
The cat
```

then

The cat

is echoed back in a successful test.

If the terminal/PC is set for half duplex, then characters will be duplicated. For example, if set for half duplex (local echo) and the user slowly types in

```
The cat
```

then

TThhee ccaatt

is echoed back in a successful test.

Quick-Reference Summaries

E

This appendix contains quick-reference summaries for the following data:

- AT Command Set
- Dial Modifiers
- S-Registers
- Result Codes
- Factory-Default Configuration
- M9/F25 Adapter Pin Assignments
- ASCII Character Set

Table E-1. AT Command Set

Command	Description
AT	Command prefix — precedes most commands.
A	Answer an incoming call.
A/	Repeat the last command line.
D	Enter originate mode and dial number that follows.
E0	Inhibit command state echo.
E1	Enable command state echo.
H0	Go on-hook (hang up).
H1	Accepted but causes no action.
I0	Returns decimal number 249 to data terminal.
I1	Returns ROM checksum as two 4-digit hexadecimal numbers.
I2	Returns ***OK***.
0	Return to on-line mode.
Q0	Enable display of result codes.
Q1	Disable display of result codes.
S*r*	Set pointer to S-register *r*.
S*r*=*n*	Set S-register *r* to value *n*.
S*r*?	Display value stored in S-register *r*.
V0	Display short form (numeric) result codes.
V1	Display verbose form (text) result codes.
X0	Enables features of result codes 0-4.
X1	Enables features of result codes 0-5, 10-12, 14.
X2	Enables features of result codes 0-5, 10-12, 14.
X3	Enables features of result codes 0-5, 7, 10-12, 14.
X4	Enables features of result codes 0-5, 7, 10-12, 14.
Z0	Reset and recall stored configuration profile 0.
Z1	Reset and recall stored configuration profile 1.
&C0	Maintain DCD circuit in ON state.
&C1	DCD circuit operates according to EIA/TIA-574 specification.

Table E-1. AT Command Set — *Continued*

Command	Description
&D0	Ignore DTR signal.
&D1	Return to command mode if ON/OFF transition of DTR is detected; active call is *not* disconnected.
&D2	Return to command mode if ON/OFF transition of DTR is detected; active call is disconnected.
&D3	Perform reset if ON/OFF transition of DTR is detected; active call is disconnected.
&F	Recall factory-default configuration profile.
&S0	Maintain DSR circuit in ON state.
&S1	DSR circuit operates according to EIA/TIA-574 specification.
&T0	Terminate any test in progress.
&T1	Initiate local loopback test.
&T2	Same as &T1.
&T3	Initiate local data loopback test.
&T4	Allow remote loopback requests from remote endpoint.
&T5	Deny remote loopback requests from remote endpoint.
&T6	Initiate remote loopback test.
&T7	Initiate remote loopback test with self-test.
&T8	Initiate local loopback test with self-test.
&V	Display active and stored configuration profiles and telephone numbers.
&W0	Store active configuration profile in location 0.
&W1	Store active configuration profile in location 1.
&Y0	Recall configuration profile stored in location 0 at start-up.
&Y1	Recall configuration profile stored in location 1 at start-up.

Table E-1. AT Command Set — *Continued*

Command	Description
&Z0	Store the following telephone number in location 0.
&Z1	Store the following telephone number in location 1.
&Z2	Store the following telephone number in location 2.
&Z3	Store the following telephone number in location 3.

Table E-2. Dial Modifiers

Dial Modifier	Description
P	Initiate voice call — follows the dial command.
T	Initiate data call — follows the dial command.
,	Comma — pause characters.
;	Semicolon — return to the command mode.
S=*n*	Dial the telephone number stored with the &Z*n*=*x* command.

Table E-3. S-Register Summary

Register	Description	Range/Unit
S0	Ring to answer on.	000-255 count
S1	Incoming ring count.	000-255 count
S2	Escape sequence character.	000-127 ASCII
S3	Carriage return character.	000-127 ASCII
S4	Line feed character.	000-127 ASCII
S5	Backspace character.	000-032, 127 ASCII
S6	Blind dial delay for voice calls.	000-255 seconds
S7	Wait time for call completion.	001-255 seconds
S8	Duration of delay for pauses.	000-255 seconds
S9	Carrier Detect Response time.	000-255 0.1 seconds
S10	Delay between lost line and hang up.	000-255 0.1 seconds
S11	DTMF tone duration.	000-255 milliseconds
S12	Escape sequence guard time.	000-255 0.02 seconds
S13	Not used.	—
S14	Bit-mapped options (see Appendix C).	00-FF hex.
S15	Not used.	—
S16	Test function status (see Appendix C).	00-FF hex.
S17	Not used.	—
S18	Diagnostic test duration timer.	000-255 seconds
S19	Not used.	—
S20	Not used.	—
S21	Bit-mapped options (see Appendix C).	00-FF hex.
S22	Bit-mapped options (see Appendix C).	00-FF hex.
S23	Bit-mapped options (see Appendix C).	00-FF hex.
S24	Installation options (see Chapter 2).	00-FF hex.
S25	DTR change detect time.	000-255 0.01 seconds
S26	RTS to CTS delay interval.	000-255 0.01 seconds
S27	Bit-mapped options (see Appendix C).	00-FF hex.

Table E-4. Result Codes

Verbose Form	Numeric	Description
OK	0	Command accepted.
CONNECTED	1	Connection made at 300 bps. **NOTE:** If command `X0` is in effect, ***CONNECTED*** means connection made at whatever speed both ends of the call agreed upon.
RING	2	Ring signal detected.
NO CARRIER	3	Carrier signal not detected or lost.
ERROR	4	Error in command line.
CONNECT 1200	5	Connection made at 1200 bps.
BUSY	7	Busy signal detected.
CONNECT 2400	10	Connection made at 2400 bps.
CONNECT 4800	11	Connection made at 4800 bps.
CONNECT 9600	12	Connection made at 9600 bps.
CONNECT 19200	14	Connection made at 19200 bps.

Table E-5. Factory-Default Configuration

Parameter	Value	AT Command
Not used	—	B1
Command state echo	enabled	E1
Not used	—	L2
Not used	—	M1
Result codes	enabled	Q0
Auto-answer on ring	disabled	S0=0
Ring count	0 rings	S1=0
Escape sequence character	ASCII 43	S2=43
Carriage return character	ASCII 13	S3=13
Line feed character	ASCII 10	S4=10
Backspace character	ASCII 8	S5=8
Wait for blind dial (voice call)	2 seconds	S6=2
Wait for call completion	60 seconds	S7=60
Pause time for comma	2 seconds	S8=2
DCD circuit detection	.6 seconds	S9=6
Hang up after lost carrier	1.4 seconds	S10=14
DTMF duration	95 milliseconds	S11=95
Escape sequence guard time	1 second	S12=50
Test timer duration	0 seconds	S18=0
DTR detection	0.05 seconds	S25=5
CTS delay interval	0 seconds	S26=0
Result code format	text	V1
Result code subset	0-5, 7, 10-12, 14	X4
Not used	—	Y0
DCD circuit option	always on	&C0
DTR circuit option	DTR ignored	&D0
Not used	—	&G0
Not used	—	&J0
Not used	—	&L0

Table E-5. Factory-Default Configuration — *Continued*

Parameter	Value	AT Command
Not used	—	&P0
Not used	—	&Q0
Not used	—	&R0
DSR circuit option	always on	&S0
RDL request	granted	&T4
Default user profile	profile 0	&Y0

Table E-6. M9/F25 Adapter Pin Assignments

Pin	Circuit	Common Name	Direction	Lead Name
1	CF	RLSD *or* DCD	from 8400B Plus Data Module	Received Line Signal Detector *or* Data Carrier Detector
2	BB	RD	from 8400B Plus Data Module	Received Data
3	BA	SD	to 8400B Plus Data Module	Transmitted Data
4	CD	DTR	to 8400B Plus Data Module	DTE Ready
5	AB	SG	common	Signal Ground
6	CC	DSR	from 8400B Plus Data Module	DCE Ready
7	CA	RTS	to 8400B Plus Data Module	Request To Send
8	CB	CTS	from 8400B Plus Data Module	Clear To Send
9	CE	RI	from 8400B Plus Data Module	Ring Indicator

Table E-7. ASCII Character Set

ASCII Value	Control Character	Key
000	NUL	CTRL @
001	SOH	CTRL A
002	STX	CTRL B
003	ETX	CTRL C
004	EOT	CTRL D
005	ENQ	CTRL E
006	ACK	CTRL F
007	BEL	CTRL G
008	BS	CTRL H
009	HT	CTRL I
010	LF	CTRL J
011	VT	CTRL K
012	FF	CTRL L
013	CR	CTRL M
014	SO	CTRL N
015	SI	CTRL O
016	DLE	CTRL P
017	DC1	CTRL Q
018	DC2	CTRL R
019	DC3	CTRL S
020	DC4	CTRL T
021	NAK	CTRL U
022	SYN	CTRL V
023	ETB	CTRL W

Table E-7. ASCII Character Set — *Continued*

ASCII Value	Control Character	Key
024	CAN	CTRL X
025	EM	CTRL Y
026	SUB	CTRL Z
027	ESC	CTRL [
028	FS	CTRL \
029	GS	CTRL]
030	RS	CTRL ^
031	US	CTRL _
032		SPACEBAR
033		!
034		"
035		#
036		$
037		%
038		&
039		'
040		(
041		)
042		*
043		+
044		,
045		-
046		.
047		/

Table E-7. ASCII Character Set — *Continued*

ASCII Value	Control Character	Key
048		0
049		1
050		2
051		3
052		4
053		5
054		6
055		7
056		8
057		9
058		:
059		;
060		<
061		=
062		>
063		?
064		@
065		A
066		B
067		C
068		D
069		E
070		F
071		G

Table E-7. ASCII Character Set — *Continued*

ASCII Value	Control Character	Key
072		H
073		I
074		J
075		K
076		L
077		M
078		N
079		O
080		P
081		Q
082		R
083		S
084		T
085		U
086		V
087		W
088		X
089		Y
090		Z
091		[
092		\
093		]
094		^
095		_

Table E-7. ASCII Character Set — *Continued*

ASCII Value	Control Character	Key
096		`
097		a
098		b
099		c
100		d
101		e
102		f
103		g
104		h
105		i
106		j
107		k
108		l
109		m
110		n
111		o
112		p
113		q
114		r
115		s
116		t
117		u
118		v
119		w

Table E-7. ASCII Character Set — *Continued*

ASCII Value	Control Character	Key
120		x
121		y
122		z
123		{
124		|
125		}
126		~
127	DEL	DELETE

Glossary

A

Asynchronous data communications
A method of communicating data in which each “character” (a 7- or 8-bit data word) is sent or received separately at a selectable data transfer rate, and is framed by extra bits preceding and following the character. Various error-checking methods use the total bit-count to determine whether the character received at one end of the data path is the same as the one sent at the other end. Also called asynchronous mode, this method, as opposed to synchronous mode, does not use a clock signal to meter data. (Since the 8400B Plus Data Module operates only in asynchronous mode, synchronous mode is not defined in this glossary.) *See also* data options.

AT command set
A de facto industry-standard set of commands used for configuration and operation of DCE devices or modems. The AT (Attention) command set originated with Hayes Microcomputer Products, Inc. The Lucent Technologies 8400B Plus Data Module uses a subset of the full AT command set.

C

Command files
Files created for or by data communications software running on a PC that can be used to execute a sequence of commands to complete a task, such as performing an automatic login to a specific remote device. Also called script files.

Command line
A string of one or more valid and compatible AT commands typed on one line with any applicable arguments. Most command lines begin with the AT prefix and end with a carriage return (issued by pressing ENTER).

Command mode
An operating mode in which the 8400B Plus Data Module looks at all characters coming from its associated terminal device and attempts to interpret them as commands. *See also* on-line mode.

Communications parameters
See data options.

Configuration profiles
See option profiles.

D

Data Communications Equipment (DCE)
(Also called Data Circuit-terminating Equipment) The equipment that provides the functions required to establish, maintain and terminate a data communications connection. The DCE also provides any required signal conversion for communication between the data terminal equipment (DTE) and the telephone line or data circuit.

Data metering
A selectable feature of the 8400B Plus Data Module that allows the device and its associated terminal to operate at a higher speed than the remote system to which it is connected.

Data mode
See on-line mode.

Data options
For asynchronous data communications, these parameters include data transfer speed (expressed in bits/second or bps, and sometimes called baud rate), parity, data word size (or data bits), and stop bits. Generally, these parameters must be set to match at both ends of the communication line. Except when the data metering option is enabled, the 8400B Plus Data Module attempts to adjust to match the speed of the remote device. If the data module is unable to match the speed, the call is disconnected. Also called communications parameters. *See also* asynchronous data communications *and* data metering.

Data Terminal Equipment (DTE)
A device that sends and/or receives data over a communication line via a DCE. Examples of DTE devices are a display terminal, a PC running appropriate data communications software, or a printer or plotter.

DCE
See Data Communications Equipment.

DCP
See Digital Communications Protocol.

Dial modifier
Any character that may be inserted in a command line following the D (dial) command. *See* the D command *in* Appendix A and Appendix B for a description of valid dial modifiers.

Digital Communications Protocol (DCP)
A proprietary digital protocol used by the Lucent Technologies DEFINITY Communications System to communicate with Lucent Technologies voice terminals and data modules. DCP supports simultaneous voice and data services over the same line.

DTE
See Data Terminal Equipment.

D8W
A standard modular telephone cord used to connect DCP devices to a PBX wall jack.

E

EIA-232-D
A US industry-standard interface for digital data communications equipment, established by the Electronics Industries Association (EIA). The standard defines the cabling, connectors, and lead signal assignments used in the interface. Formerly referred to as the EIA Recommended Standard RS-232-C.

EIA/TIA-574
The Electronics Industries Association (EIA) Telecommunications Industry Association (TIA) nine-pin equivalent of the standard EIA-232-D interface.

H

Hayes compatible
Of a DCE device, using the AT command set and performing in close compliance with the configuration and operating standards established by Hayes Microcomputer Products, Inc. *See also* AT command set.

I

Idle mode
An operational mode in which the 8400B Plus Data Module is on-hook waiting either for an incoming call or to originate a call.

L

Linked mode
An installation option, also called *With Telephone*, in which the 8400B Plus Data Module supports both data and voice services.

O

On-line mode
An operating mode in which the 8400B Plus Data Module transmits all characters coming from its associated terminal device and does not attempt to interpret them as commands. Also called data mode. *See also* command mode.

Option profiles
See configuration profiles.

S

Script files
See command files.

Stand-Alone mode
An installation option, also called *Without Telephone*, in which the 8400B Plus Data Module supports only data services.

T

Terminal mode

Of PC communications packages, the operating mode of the software in which a PC is emulating a data terminal. In this operating mode, the user may be communicating with either the data module or a remote device, such as a host computer. *See also* stand-alone mode *and* on-line mode.

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